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COMMERCIAL FISHERIES REVIEW

A REVIEW OF DEVELOPMENTS AND NEWS OF THE FISHERY INDUSTRIES
PREPARED IN THE DIVISION OF COMMERCIAL FISHERIES

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COMMERCIAL FISHERIES REVIEW

October 1947 Washington 25, D.C. Vol. 9, No. 10

BACTERIAL POPULATION OF BRINING TANKS IN FISH FILLETING PLANTS

By Jean C. Hartshorne*

ABSTRACT

The data indicate that brining tanks used in washing fish fillets can be an important source of contamination. Manual control of chlorine and salt concentration of brine was not effective to maintain continuously the desired levels. Automatic control is recommended. Some means should also be used to remove the debris continuously.

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INTRODUCTION

Shortly after the Boston Technological Laboratory acquired its mobile laboratory unit, sea food producers in the New England area requested that "on the spot" studies of their filleting process methods be undertaken. Previous to initiating studies, a number of producers were interviewed to determine what steps in the processing needed particular attention. From the interviews, it became quite apparent that the brine solutions through which the fish fillets pass before packaging were of particular concern to all, primarily from the bacteriological standpoint.

FACTORS CONCERNING THE BRINING OF FISH FILLETS

Brining tanks in fish filleting plants serve a fourfold purpose; namely:

1. To condition fillet surfaces so that the "drip" during thawing of the frozen product be reduced.

2. To lessen the tendency of the fillets to adhere to one another in the packaged product.

3. To clean the fillets physically from unavoidable slime and fish scales collected in the filleting operations.

4. To reduce the bacterial load of the fillets by the washing effect of the brine.

The latter would be highly important should freezing of the packaged fillets be delayed or the shipment be made as chilled fillets.

Brine strength and brining time vary according to the species of fish handled to insure optimum results. For example, Stansby and Harrison (1942) found that brining for 20 seconds in 15 percent brine (60° salinometer) reduced the drip of frozen Cape sole (low fat content) fillets from 6 to 2 percent. The average leak-

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age of unbrined, quick-frozen silver salmon was 1.8 percent; whereas that of the brined product was 0.4 percent. Brined pink salmon (high fat content) fillets stored at -5° F. were slightly rancid after two months, although unbrined fillets were still fresh, indicating that brining hastened the development of rancid flavors in fat fish and should be avoided. Lemon (1947) advocated a brine strength of 25° to 35° salinometer and the use of chlorine to the amount of 3 to 5 parts per million. Maintenance of this concentration of chlorine and holding the temperature of the brine at 35° to 45° F. were thought to be important if the fillets were not to be damaged during the brining operations.

BRINING TANK

Vucassovich (1947) designed an apparatus for simultaneously conveying, washing, brining, and precooling food products for freezing. In brining fish fillets, a brine with 12 to 14 percent salt is used. Chilled brine is circulated through stainless steel flumes which convey the fillets to the brining tank whence an elevator conveyor directs the fillets to the packing table. Absorption of salt concentration is almost constant over a 5- to 30-second contact. Consequently, there is no material difference in the amount of salt taken up by fillets dropped in flumes at varying distances from the tank. Brine is changed at intervals of two hours. A system of this type eliminates the possibility of uneven brining that sometimes occurs in static brine when fillets clump together. It would also adapt itself to continuous automatic chlorination of the brine and automatic regulation of density.

Spartales (1938) found major contamination of the filleting boards and belt in a fish filleting line to occur just previous to the brining tank; also that fillets often go through brining tanks without a residual of chlorine in the brine when manual chlorination has been applied to the tanks.

Although much work has been done on the effect of brining on the physical structure of fish fillets, very little work has been reported on the bacteriology of brining tanks. This paper discusses the brining tanks from the standpoint of bacteriological population.

OPERATIONS OF THE FISH FILLETING PLANT

The plant in which most of this work was carried out operated in a manner typical of most filleting operations in the New England fishing industry. Fish, iced and gutted, were received from carts loaded from trawlers. Placed into a bin which acted as a hopper for a conveyor, the fish were led to mechanical scalers and were washed. After being cut, the fillets were conveyed to a trimming table where they were trimmed and, if skinless fillets were being prepared, were skinned. The finished fillets were conveyed through a 50-gallon stainless steel brining tank to a drain board and subsequently packaged.

The brine was renewed at 2-hour intervals. All plant equipment was washed down and the lines flushed with fresh water as the brine was being changed. Saturated brine was prepared in a storage tank and was piped into the brining tank for dilution to the salinity desired. In operation, the tank was replenished when the level lowered due to loss by adherence to fillets passing through.

CONDITION OF BRINE AFTER VARIOUS TIME INTERVALS

Samples of brine were withdrawn by sterile pipette from the tank every half hour during a run. A run consisted of an interval of two hours. Generally, four runs were made during each operating day. The poundage of fish fillets put through in a given run varied from 1,500 to 4,000. Variations in poundage were due to erratic supply of fillets. The brine level of the tank, salinity, cleanliness of the brine, and the rate that fillets pass through varied to the extent that sampling at the intervals stated, could well be expected to show variations in bacterial counts. It was felt, however, that a trend in population could be demonstrated if a sufficient number of runs were sampled.

Ten ml. of the sample were diluted to suitable dilutions. Nutrient agar plates were poured in duplicate and were incubated at 37° C. for 48 hours. Salinity, temperature, and pH readings were taken at each sampling. A Beckman pH meter was used for determinations of the hydrogen-ion concentration, and a hydrometer graduated in percent saturation was used for determining the salinity.

Findings

The bacterial population, salinity, temperature, and pH of the brine for seven runs are shown in Table 1. These data show that there is a rapid rise in the bac-

Table 1 - Bacterial Population, Salinity, Temperature, and H-ion Concentration of Brine After Various Time Intervals

Time of sampling (hours)	0	0.5	1.0	1.5	2.0
Run No. 1 - mixed skinned and unskinned haddock, approx. 4,000 lbs.					
Bacteria per ml. brine	54,000	920,000	960,000	1,110,000	834,000
Salinity (% sat.)	47	48	55	52	65
Temp. °C.	11	11	11	10	10
pH	6.22	6.18	6.10	6.15	6.10
Run No. 2 - mixed skinned and unskinned haddock, approx. 3,000 lbs.					
Bacteria per ml. brine	34,000	268,000	760,000	600,000	360,000
Salinity (% sat.)	38	37	35	39	37
Temp. °C.	11	11	11	10	11
pH	6.25	6.20	6.26	6.19	6.20
Run No. 3 - unskinned haddock, approx. 2,800 lbs. fish fillets - not full run					
Bacteria per ml. brine	27,800	117,000	518,000	915,000	
Salinity (% sat.)	40	39	36	48	
Temp. °C.	13	13	13	13	
pH	5.68	6.22	6.24	6.19	
Run No. 4 - unskinned haddock, approx. 3,000 lbs. fish fillets - not full run					
Bacteria per ml. brine	27,800	319,000	500,000	813,000	
Salinity (% sat.)	47	58	50	55	
Temp. °C.	12	11	11	11	
pH	6.11	6.00	6.20	6.16	
Run No. 5 - unskinned haddock, approx. 3,000 lbs. fish fillets					
Bacteria per ml. brine	10,800	350,000	790,000	910,000	1,070,000
Salinity (% sat.)	48	50	50	58	56
Temp. °C.	12	10	10	10	10
pH	6.02	6.16	6.27	6.16	6.15
Run No. 6 - mixed skinned and unskinned haddock, approx. 1,500 lbs.					
Bacteria per ml. brine	8,800	545,000	340,000	575,000	
Salinity (% sat.)	95	94	90	89	
Temp. °C.	13	13	12	12	
pH	5.66	5.77	5.90	5.92	
Run No. 7 - unskinned haddock, approx. 3,000 lbs.					
Bacteria per ml. brine	12,000	118,000	203,000	1,270,000	600,000
Salinity (% sat.)	95	91	84	80	79
Temp. °C.	14	12	11	11	11
pH	5.56	5.90	5.97	6.02	6.09

terial population of the brine as the run progresses, with a tendency for the count to level off and drop slightly, in some cases, toward the end of a two-hour run.

The brine strength apparently has no real effect on the bacterial population. The temperature remains essentially constant due probably to the chilled fish from the carts moving steadily along the production line. The pH rises slightly as more fish pass through the tank, but is effected also by the strength of brine, being lower, in general, when the brine is more concentrated. The probable cause of the rapid increase in the bacterial count is associated with the washing action of the brine at the initial stages of the run. This activity is reduced as more fish pass through the tank. Variations develop and are promoted by the erratic supply and flow of fillets. Other variables are brine level, salt concentration, age of the fish, and mixed fish in the same run. More consistent trends in the bacterial counts could hardly be expected without more exacting control; however, the results of the seven runs indicate that some means should be employed to keep the bacterial count down in the brining tanks.

CONDITION OF FILLETS BEFORE AND AFTER BRINING

Gutted and headed fish were removed from the line and filleted by hand. Skinned or unskinned fillets were cut and equal portions of approximately 50 grams were taken from the head end of each fillet, one being retained and the other being passed through the brining tank as in commercial practice. It was assumed that the two pieces of fillets from the same fish and the same part of the fish would have similar initial bacterial populations. The brined and unbrined samples were placed in a sterile Waring blendor containing 200 ml. of water to be slurried for sampling. Ten ml. of the slurry were removed for subsequent dilution and plating. A sample of the brine was taken at the same time as the fillets were put through the tank.

Findings

The results of the sampling (Table 2) indicate that the brine in the initial stages of the run is effective in producing a slight washing action to the fillets

Table 2 - Bacterial Counts on Fish Fillets Before and After Brining

Sample No.	Properties of Brine	Fillet Before Brining Bacteria per gm.	Fillet After Brining Bacteria per gm.	Brine Bacteria per ml.	Remarks
1	Temp. 12° C. Salinity 43%	3,640,000	1,840,000	-	Skinned cod; 800 lbs. after 30 minutes
2	Temp. 13° C. Salinity 44%	960,000	940,000	670,000	Unskinned haddock; 1,000 lbs. after 30 minutes
3	Temp. 12° C. Salinity 59% pH 6.05	310,000	460,000	780,000	Unskinned haddock; 2,000 lbs. after 1½ hours
4	Temp. 12° C. Salinity 51% pH 6.00	294,000	357,000	790,000	Unskinned haddock; 4,000 lbs. after 2 hours
5	Temp. 11° C. Salinity 51%	475,000	900,000	-	Skinned cod; 4,000 lbs. after 2 hours
6	Temp. 12° C. Salinity 54%	410,000	600,000	-	Skinned haddock; 6,000 lbs. after 2 hours

which decreases the bacterial count. The data indicate that after the brine is used for a period of approximately one hour the destructive effect on the bacterial population is lost. The data definitely show that the brining tank becomes a source of contamination as the run progresses toward completion.

EFFECT OF CHLORINE ON THE BACTERIAL POPULATION OF BRINE AND FISH FILLETS

To test the efficiency of chlorine on the bacterial population of the brine, chlorine in the form of calcium hypochlorite was added to the brine intermittently. It was rather difficult to maintain a given concentration of chlorine by manual

Table 3 - Bacterial Population of the Brine Tank with Chlorine Added

Time of Sampling (hours)	0	0.5	1.0	1.5
Run No. 1 - unskinned haddock, approx. 2,000 lbs. - not full run				
Bacteria per ml. brine	6,000	640,000	390,000	50,000
Chlorine (ppm.)	3	0.75 (added)	0.5 (added)	1.0 (added)
Salinity	41	39	39	50
Temp. °C.	11.5	11	11	12
pH	5.9	6.15	6.20	6.20

means because of the rapid absorption of chlorine by the fish fillets. The results of this test are shown in Table 3. Bacterial counts on fillets after passing through chlorinated brine are shown in Table 4.

Table 4 - Bacterial Population of Fillets Passing Through Chlorinated Brine

Sample No.	Properties of Brine	Fillet Before Brining Bacteria per gm.	Fillet After Brining Bacteria per gm.	Brine Bacteria per ml.
1	4 ppm. chln., sal. 45% temp. 12° C., pH 6.5	125,000	33,000	0
	Remarks - unskinned haddock, no fish through brine at initial part of run - chlorine gone at check with 500 lbs. of fillet through.			
End of run	0 ppm. chln., sal. 70% temp. 12° C., pH 6.0	100,000	200,000	790,000
	Remarks - unskinned haddock, 2,000 lbs. fish through at the end of run (2 hrs.) slow operations with miscellaneous haddock and cod completing the run.			
2	6 ppm. chln., sal. 43% temp. 13° C., pH 6.3	365,000	50,000	0
	Remarks - skinned haddock, no fish through brine, initial part - chln. at 2 ppm. in matter of minutes.			

Findings

The addition of chlorine to the brining tank keeps down the count in the brine; however, the chlorine demand is such that a residual cannot be maintained by manual application for more than a few minutes. It would be erroneous to assume that a single application of a reasonable concentration of chlorine, one which would not impair the flavor of the fillets, would last and be effective for a whole brining period. There are definite indications that the bacterial count of the fillets can be reduced markedly by the proper use of chlorine in the brining tanks, giving the assurance of a more wholesome product during storage and shipment.

CONCLUSIONS AND RECOMMENDATIONS

The limited data indicate that brining tanks of fish filleting lines can be a potential source of contamination to fish fillets. It is recommended, therefore, that consideration be given to the improvement of the brining technique through the proper addition of chlorine and such means as may be economical for removing the debris from the tank while in operation. The chlorine concentration should be automatically controlled to maintain an effective residual. Also, the salt concentration should be automatically controlled, primarily for the purpose of maintaining a uniform appearance and taste of the filleted fish product. In conjunction with this, some means of insuring a more uniform brining of all fillets in the tank should be incorporated in the brining system for better quality control.

Some means of keeping the brine clean over a given period through the installation of a filter device with a recirculator should be considered. A combination of these improvements would produce a fillet relatively low in bacterial count at any time in the run, a clean fillet with no slime or adhering scales, and a fillet with a uniform brine film.

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ADULTERATION AND MISBRANDING

A food is adulterated if it bears or contains any poisonous or deleterious substance. It is adulterated if it consists in whole or in part of a filthy, putrid, or decomposed substance, or is otherwise unfit for food, or has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth or rendered injurious to health. It is adulterated if it is in whole or in part the product of a diseased animal. A food is misbranded if its labeling is false or misleading in any particular, or if it is offered for sale under the name of another food, or if its label fails to bear its common or usual name if it has any. The above are not all of the adulteration and misbranding provisions applicable to fishery products, of course, but are those which give most concern at times.

--Statement by L. D. Elliott, Assistant Commissioner of Food and Drugs, Food and Drug Administration, Federal Security Agency, before the National Resources Economic Subcommittee of the Senate Committee on Public Lands, July 2, 1947.

FEEDING STUDIES WITH LIPOID EXTRACTS FROM MENHADEN FISH MEAL 1/

By Herman F. Kraybill* and Hugo W. Nilson**

ABSTRACT

Lipoid material extracted from commercial and from experimentally spoiled menhaden meal were found to be absorbed equally well from the gastro-intestinal tract of rats. Toxic symptoms were not found even when the extracts were fed at levels exceeding that present in an all-fish-meal diet.

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INTRODUCTION

The results of recent feeding studies indicate rather definitely that the free fatty acids in edible oils and food products do not produce toxic effects. Branion, et al, (1938) have reported that no toxic symptoms developed when free fatty acids and nitrogenous compounds found in cod liver oil were fed to poultry. There has been a tendency to condemn oils of high free fatty acid content for poultry feeding purposes because of clinical observations that cod liver oil with a free fatty acid content greater than one percent caused nausea in infants. Burr (1939) reviewed the data reported by several investigators and concluded that only when excessive amounts of pure fatty acids were fed, were toxic effects noted. The toxicity of only butyric and lauric acids had been investigated.

Whipple (1932) reported that the presence of oxidized oil decreases the nutritive value of the original fresh material and leads to digestive and other disturbances. In a comparative study with dogs and rats, she also found that those animals which were fed experimentally oxidized lard developed a disease

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1/ The data in this paper were included in a thesis submitted by Dr. Herman F. Kraybill to the faculty of the Graduate School of the University of Maryland in partial fulfillment of the requirements for the degree of Doctor of Philosophy. The authors wish to acknowledge the helpful assistance of Dr. W. C. Supplee of the University of Maryland in the conduct of these experiments.

NOTE: An article entitled "Chemical Studies of Lipoid Extracts from Menhaden Fish Meal," by Herman F. Kraybill and Hugo W. Nilson, appeared in the September 1947 issue of Commercial Fisheries Review, pp. 8-18.

which she called "oxidized fat syndrome." All of the animals fed the oxidized lard died, while those fed the unoxidized lard remained in good health. Whipple pointed out that rancid fats are generally believed to be gastric irritants, and she suggested that slightly rancid oil may well be the cause of the digestive disturbances that mothers so often attribute to cod liver oil. Branion, et al, (1938), however, in their experiments with poultry fed "blown" or oxidized cod liver oil, found that oxidation products formed during the development of rancidity did not produce any toxic symptoms.

Gautier, et al, (1888) have shown that those impurities in cod liver oil which are of liver protein origin are toxic. Cook and Scott (1935) suggested that the nitrogenous bases present in poultry rations containing fish meal are the cause of an intoxication syndrome consisting of slightly prolonged blood clotting time, slight hemorrhages, and non-hemorrhagic anemia. Almquist and Stokstad (1937) were unable to corroborate this finding. They found that the addition of trimethylamine or other amines did not produce the deleterious effects observed by Cook and Scott but did result in a decreased growth rate due to low food consumption. Decomposition may also result in a decreased nutritive value of fish oils due to partial destruction of the vitamin A.

The most probable source of so-called oxidized oils in farm animal rations is fish meal. Nutritional difficulties reported by farmers have been attributed to the fish meal in the rations fed. In practically all cases the conclusion was based on unsupported opinion, since no control animals had been fed a similar ration free from fish meal. When feeding up to 30 percent of experimentally spoiled pilchard meal to chicks, Lanham and Nilson (1947) did not find a decrease in the nutritive value of the meal, or an adverse effect on the flavor of the flesh except in very few instances. This finding was also true for ducklings (Nilson, 1946).

Vestal, et al, (1945) fed a basic diet of ground yellow corn, 88.0; alfalfa-leaf meal, 2.0; and menhaden meal, 10.0 parts by weight, to a control group of pigs. Similar diets in which 0.5 and 1.5 parts, respectively, of the ground yellow corn were replaced by menhaden body oil were fed to two other groups of pigs. All three groups gained equally well, although the pigs that received the menhaden oil in their diets produced pork having a decided fishy flavor. The flavor of the flesh is apparently affected differently when fish meal and fish oil are fed to different species.

In view of the conflicting data reported in the literature, it was deemed desirable to investigate:

(a) The rate at which lipoid extracts from commercial or experimentally spoiled menhaden meal were absorbed from the gastro-intestinal tract.

(b) The physiological effects caused by the inclusion of such extracts in the diet.

The chemical characteristics of these extracts have been previously described by Kraybill and Nilson (1947).

EXPERIMENTAL METHODS AND DATA

Two extracts were tested in these experiments. One was from a commercial menhaden meal such as is regularly sold for animal feeding purposes, and the second was from a sample of the same meal which had been subjected to experimental spoilage in simulation of unfavorable storage conditions. The meal was spoiled by being

moistened with water, and allowed to stand for about three weeks at 38° C. There was extensive bacterial and mold growth during this period. The meal was then dried at a temperature under 50° C.

The solvent mixture was composed of 50 percent benzol, 25 percent methanol, and 25 percent acetone by volume. A continuous extraction apparatus was used which consisted of a 12-liter round-bottom flask supported on a sand bath heated by an electric hot plate. The round bottomed flask was connected by means of a syphon tube to a "Knightware" ceramic extractor with a capacity of about 10 liters. A Liebig condenser was fitted to the top of the extractor to condense the solvent.

The solvent-free extracts from the two types of meal contained about 55 percent combined saturated and unsaturated fatty acids, as compared with 88 percent in a commercial cold-pressed oil. The unsaturated fatty acid content made up 62 percent of the combined acids in the extract from commercial meal, and 68 percent in the extract from the spoiled meal. The unsaponifiable matter was 3 and 5 percent, respectively, for the commercial and spoiled meal extracts and the contents of resinous material 15 and 10 percent, respectively. There was no difference in the amount of water-soluble fraction in the extracts. The two types of extracts were very similar in respect to color and odor (Kraybill and Nilson, 1947).

MENHADEN

The first objective of these experiments was to measure the degree of absorption of the extracts from the gastro-intestinal tract. The second objective was to determine whether acute toxicosis resulted when the extracts were fed in fairly high levels over a reasonable period of time.

ABSORPTION FROM THE GASTRO-INTESTINAL TRACT

Adult male rats of about equal live weight were used as test animals. These were fed a fat free basal diet for two to three days and then fasted for about 6 hours before the tests were made. Control rats were then killed, and the quantity of solvent-extractable material in the gastro-intestinal tract was determined so that a proper correction could be made in the experimental results. The residual fat amounted to an average of 36 mg., in good agreement with the 33 mg. reported by Deuel (1939).

Approximately one gram of test material was given by stomach tube to each rat. After intervals of 5 minutes and 4, 6, and 8 hours, paired rats were killed and the gastro-intestinal tract from the esophagus to the cecum, inclusive, was removed intact. The contents were squeezed out by massage of the tract, and all organs were washed out with warm water and the previously mentioned solvent mixture. After acidification of the contents and the rinsings from the stomach and intestine, the combined water and solvent layer was separated from inert matter. The solvent containing the fatty material was dried with anhydrous sodium sulfate and filtered, and the solvent was evaporated off. The amount of residue found represented the non-absorbed portion of the extract given by stomach tube.

The data in Table 1 show that the differences, in the quantity of the same extracts absorbed by paired animals, were very small ranging from 0.5 to 4.6 percent. This is satisfactory agreement.

At the 5-minute, and 8-hour intervals the extract from the commercial meal was absorbed slightly better than the extract from the spoiled meal, and the opposite was true for the 4- and 6-hour intervals. The range in differences between averages of pairs fed the two extracts was 4.2 to 9.9 percent. Calculations

Table 1 - Data on Absorption of Lipoid Extracts from Menhaden Meal from the Gastro-Intestinal Tract of Rats After Various Time Intervals

Source of oil	Live weight of rats	Extract fed by stomach tube	Time interval	Extract recovered	Extract absorbed
	Grams	Grams	Hours	Grams	Percent
Commercial meal	392	0.944	1/12	0.776	17.8
	302	1.054	1/12	0.862	18.2
	360	1.070	4	0.857	19.9
	296	0.670	4	0.529	22.4
	274	1.320	6	0.504	61.8
	305	1.120	6	0.488	56.4
	359	1.290	8	0.267	79.3
	400	1.320	8	0.242	81.6
Spoiled meal	362	1.099	1/12	0.942	14.3
	300	1.300	1/12	1.125	13.5
	300	0.856	4	0.607	29.1
	298	0.958	4	0.685	28.5
	335	0.938	6	0.281	70.0
	307	0.938	6	0.401	67.9
	300	1.063	8	0.246	76.8
	340	1.080	8	0.244	77.4

Note: The average weight of solvent-extractable material in the gastro-intestinal tract of control rats was 0.0362 grams.

indicate that differences in excess of 10 percent are required to be statistically significant. Accordingly, these results indicate that the rats absorbed the two materials with equal efficiency.

Feeding Studies

Since there were no significant differences in the degree of absorption of these extracts, it was deemed desirable to determine whether any toxicosis would result when they were fed at rather high levels over a reasonably long period of time. Additional samples of each extract were washed with either water or approximately 0.5N hydrochloric acid to remove nitrogenous decomposition products which in themselves might be toxic. Paired groups of rats were fed the original extracts, the washed extracts, and the washed extracts to which the wash-water concentrate was added.

Preliminary feeding studies indicated that the maximum quantity of extract from commercial meal which could be included in the diet without decreasing food consumption was about 15 percent. This quantity of extract is in excess of that which would be found in an all-fish-meal diet. It is about 5 times that found in an experimental diet which contained 30 percent fish meal (Lanham and Nilson, 1947). The average farm animal ration seldom contains more than about 10 percent fish meal.

The rats were started on the experiment after being weaned at live weights of from 38 to 68 g. In most cases, the range was 40 to 55 g. The animals were housed individually in wire cages fitted with screen floors, and the cages were kept in an air-conditioned room. Several series of experiments using the same materials were conducted in some instances.

The basal diet fed ad libitum consisted of:

	Percent by weight		Percent by weight
Extract or lard	15.0	Agar	5.3
Casein, technical	15.9	Yeast, dried brewer's, extracted	2.2
Lactalbumin, "	5.3	Salt mixture, U.S.P. XI, No. 2	4.2
Dextrin, tapioca	30.8		
Sucrose	21.3		

The fat-free, dried brewer's yeast was prepared by continuous extraction of yeast with diethyl ether and alcohol as recommended by Mackensie and co-workers (1939). To each 10 kilograms of diet were added 1,000 international units of vitamin A in the form of technical, crystalline carotene, 60 mg. of Delsterol in oil (vitamin D_3), 2.4 mg. of thiamine, and 0.6 mg. of riboflavin. The diets were made up every third day in order that they would contain the extracts and the vitamin supplements in substantially unchanged form.

Table 2 - Data on the Mean Food Intake and Gain in Liveweight of Rats Fed Various Lipoid Extracts from Menhaden Meal at a 15 Percent Level in the Diet During a 6-Week Period

Group	Product fed	Number of rats	Food mean intake	Gain in mean liveweight	
				Actual	Estimated 1/
			Grams	Grams	Grams
1	Lard	11	332.09	91.09	75.63
2	Commercial meal extract	16	371.56	77.88	89.19
3	Spoiled meal "	14	269.93	45.79	54.28
4	Commercial meal extract, acid-washed.	15	291.20	60.07	61.59
5	Spoiled meal " , " "	14	250.93	47.86	47.75
6	Commercial meal extract, water-washed	4	355.00	76.50	83.50
7	Spoiled meal " , " "	4	415.00	96.00	104.11
8	Commercial meal " , acid-washed plus acid wash concentrate	15	304.80	62.60	66.25
9	Spoiled meal extract, acid-washed plus acid wash concentrate	13	267.69	45.38	53.51
10	Commercial meal extract, water-washed plus water wash concentrate	4	332.25	73.00	75.69
11	Spoiled meal extract, water-washed plus water wash concentrate	4	379.25	90.00	91.83
12	Lard, 12 percent, and commercial meal extract, 3 percent	6	314.50	96.17	69.59
13	Lard, 12 percent, and spoiled meal extract, 3 percent	12	329.00	90.67	74.57
	Over all mean		310.31	68.15	
	Summary:				
	Lard (Groups 1, 12, and 13)	29	323.38	91.97	72.64
	Commercial meal extract (Groups 2, 4, 6, and 8)	50	326.10	67.84	73.58
	Spoiled meal extract (Groups 3, 5, 7, and 9)	45	276.27	50.78	56.46

1/ Statistical methods according to Snedecor (1940).

The data in Table 2 show that the rats fed the diets containing the 15 percent level of lard, or 12 percent of lard plus 3 percent extract of commercial or spoiled meal grew at about the same rate. During the 6-week period, there was no depressing effect on the growth of the rats receiving the extract from fish meal in this concentration, although the 3 percent level is at least three times as high as might be expected to be present in most farm animal rations. The data in Table 3 indicate that the difference between the actual gain in live weight and the gain estimated as probable when corrected to equal food intake is statistically significant.

The data in Table 2 also indicate that no significant effect was produced by washing the extract from commercial meal with either acid or water. Consequently, the data were combined for the groups fed the extract from commercial meal, the

Table 3 - Analysis of Covariance and Test of Significance of Adjusted Group Gain in Liveweight for Data Presented in Table 2

Source of variation	Degrees of freedom	Sums of squares and Products[1]			Errors of Estimate		
		Sy^2	Sxy	Sx^2	Sum of squares	Degrees of freedom	Mean square
Total	131	111,088.97	206,048.79	599,272.27	40,242.87	130	
Groups	12	44,428.13	82,766.47	240,358.99	15,927.89	11	1,447.99
Within groups	119	66,660.84	123,282.32	358,913.28	24,314.98	118	206.06

F = 7.03 which indicates a very significant difference.

1/ y equals gain in liveweight, and x equals food intake.

acid-and-water-washed extract, or the acid-washed extract plus the acid-wash concentrate. The data for the group fed the water-washed extract plus the water-wash concentrate were omitted from this summary although the animals grew at about the expected rate. This was done because the data in Table 4 show that the inner group error of the companion group fed water-washed, spoiled meal extract plus water-wash concentrate was significantly greater than the over-all error. This

Table 4 - Regression and Correlation Data for Gain in Liveweight and Food Intake

Group (Table 2)	Degrees of freedom	Correlation coefficient	Regression coefficient	Errors of Estimate	
				Sums of squares	Degrees of freedom
1	10	0.8769	0.3805	1,963.97	9
2	15	0.6678	0.2577	1,884.96	14
3	13	0.8081	0.2252	1,176.95	12
4	14	0.7590	0.3128	1,854.07	13
5	13	0.8062	0.3977	2,587.73	12
6	3	0.8693	0.4152	184.01	2
7	3	0.4464	0.1541	305.88	2
8	14	0.9108	0.5858	2,137.38	13
9	12	0.9015	0.3456	2,684.89	11
10	3	0.9427	0.2873	164.96	2
11	3	0.2415	0.2091	3,602.89	2
12	5	0.9149	0.4656	616.43	4
13	11	0.6174	0.2127	1,562.43	10
Sum mean	119	0.7970	0.3435	20,725.65	106

was the only group for which this was true. It seemed best to eliminate the data for both groups in the summaries so that direct comparisons could better be made.

A summary of data for the three classifications in Table 2 shows that the mean gain for those fed lard or lard plus extract was 92.0 g. against an expected gain of 72.6 g. or 1¼ times greater than estimated. The rats fed 15 percent of extract from commercial fish meal gained only about three-quarters as much as those fed lard or lard plus extract. The mean food intake was about the same.

The summary data in Table 2 also show that the rats fed the extract from spoiled meal oil grew about as well as those fed the extract from commercial meal when corrections were made for the generally lower food intake; that is, a mean gain of 50.8 g. against an estimated mean gain of 56.5 g. At first glance, the data in Table 2 for Group 7 would indicate that water-washing the extract removed some substance that reduced the palatability of the diet containing the extract from spoiled meal. The data in Table 4, however, show that the correlation coefficient between food intake and gain in live weight for this group is the second lowest

in the series; so too much reliance should not be given to this finding, even though, statistically, the inner group error is not significantly greater than the over-all error. As noted before, the results obtained with the paired group fed water-washed, spoiled meal extract plus water-wash concentrate had to be discounted because of large inner group error. The results on the whole indicate that the extract from the spoiled meal decreased the palatability of the food, but did not have any other depressing effect on gain in live weight not common to that of the extract from commercial meal. The extracts were apparently not toxic.

DISCUSSION

Just why the rats fed the extract from menhaden meal did not grow as well as those fed lard cannot be definitely ascertained from these studies. The mortality data are not conclusive. One rat fed the diet containing lard died in $1\frac{1}{2}$ weeks, after gaining 24 g. One rat fed the diet containing acid-washed, commercial meal extract died in $5\frac{1}{2}$ weeks, after gaining 14 g. One rat fed the acid-washed, commercial meal extract plus acid-wash concentrate died in 3 weeks, after gaining only 7 g. Apparently none of the deaths was due to malnutrition.

Two rats which were offered the diet containing extract from spoiled meal died within 3 days. One rat which was offered the diet containing acid-washed spoiled meal extract died within 3 days, and one died in 4 weeks, after gaining only 3 g. One rat which was offered the acid-washed, spoiled meal extract plus acid-wash concentrate died within 3 days. These data indicate that the diets were unpalatable to some of the rats and that the deaths were probably due to malnutrition. The gross findings on post-mortem of surviving rats from all groups were essentially negative. In some instances, a slight hyperemic condition was noted in the intestines.

The data in Table 2 show that the rats fed the extract from spoiled meal consumed less food, but the gain in live weight per unit of food intake was reasonably proportional to that of rats fed the extract from commercial meal. This indicates that it is improbable that the lower rate of growth of the rats fed the extract from the spoiled meal is attributable to a toxicosis.

Nor is it likely that a toxic condition was responsible for the smaller gain in live weight of rats fed the diets containing extracts from meal as compared with those fed lard. The differences were probably due chiefly to three factors. First, the composition of the bodies of the surviving rats was not uniform. The live weight at the close of the 6-week period ranged from 46 to 217 g. The smaller rats were undoubtedly more dehydrated, leaner, and had a higher proportion of bone than the larger rats. The gain in live weight, therefore, did not represent a weight increase of uniform composition for the various groups.

Part of the difference may have been due to the greater caloric intake from the diet containing lard. This premise is based on the assumption that lard is almost completely digested and utilized in the body, while the extract from menhaden meal is only about 80 percent digested as indicated for the 8-hour data in Table 1. It may not be so completely utilized in the body. This means that with near maximum food consumptions, about equal for size of animal, the rats fed the diets containing lard actually received more calories than those rats which consumed

diets containing extracts from menhaden meal. This probably does not account for all of the differences since calculations show that the rats fed the diets containing lard required about 1/3 less calories per unit gain in live weight than did the rats fed the extracts from commercial or spoiled meal.

The third factor responsible for differences in gain in live weight, particularly between the groups fed diets containing lard and the other was the inadequate vitamin supplementation of the basal diet which did not permit maximum growth. It was believed to be adequate for a fat free basal diet at the time the experiments were being conducted in 1940 and early 1941. Since then, other experiments have been conducted in this laboratory in which 3 percent of dried brewer's yeast, 2 percent wheat germ, and 2 percent cod liver oil were added to diets very similar to the lard-containing diets above as sources of necessary vitamins. One group of 5 rats, belonging to a strain having a larger adult size gained 209 g. with a food intake of 484 g. during the 6-week period. A second group of 5 rats of the same strain as used in the herein reported experiments gained an average of 150 g. with a food intake of 385 g. The rats from the second group, however, received corn starch instead of sugar and dextrin; and this may have decreased food consumption.

It seems most probable that the lard used in the experiments reported here contained some vitamins which permitted the rats fed this material to outgrow those fed the extract from commercial meal, even though the mean food intake was about the same. It may be concluded, therefore, that material extracted from menhaden meal does not produce any discernable toxic condition even when fed to rats in amounts greater than would be present in an all-fish-meal diet. When incorporated in diets at levels equivalent to 30 percent fish meal in the diet, there were no effects even on food consumption.

CONCLUSIONS

1. The lipoid extracts from commercial and from experimentally spoiled menhaden meal are absorbed equally well from the gastro-intestinal tract of rats.

2. About 80 percent of the extract is absorbed in an 8-hour period.

3. Toxic symptoms need not be expected even when the extracts are fed at levels exceeding that present in an all-fish-meal diet.

4. It is reasonable to believe that commercial menhaden meal may be fed to farm animals at the maximum practical level without any adverse effect of the residual oil content on either the food intake, or health of the animals.

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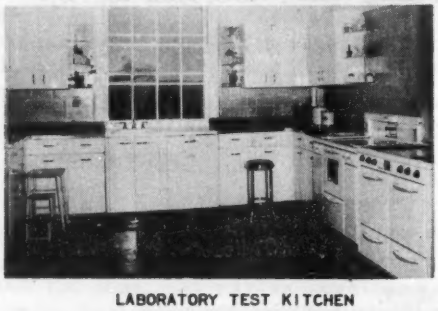
TECHNOLOGICAL RESEARCH IN SERVICE LABORATORIES

AUGUST 1947

College Park, Md.

Experimental packs of sandwich spreads for the school lunch program were prepared, utilizing fresh cod, smoked fillets, and sea herring.



LABORATORY TEST KITCHEN

* * *

Experiments were conducted on the freezing, storing, and thawing of eastern crab meat.

* * *

Recipes utilizing rosefish, lobster tails, salmon, silver hake, crab meat, sea trout, oysters, haddock, and mackerel were tested.

* * *

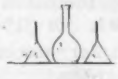
Packs of canned crab cakes and crab gumbo were prepared and tested to develop new uses for fresh-cooked eastern crab meat.

Boston, Mass.

The application of chlorine and chlorine compounds to fisheries sanitation was discussed at a meeting with technical industry representatives prior to outlining additional research.

* * *

Experimental packs of a canned fish loaf product were prepared.



Ketchikan, Alaska

Experiments to retard the growth of mold on kippered salmon were conducted with prophylene oxide.

* * *

Between 30,000 and 40,000 pounds of salmon cannery trimmings were handled in the preparation of material for studies to find new uses for this product.

* * *

Pilot plant equipment for the alkali digestion of salmon offal was tried out and further tests outlined.

* * *

Clam samples from a number of sources were collected and extracted on the vessel Researcher.

* * *

The use of a submarine growth in the jewelry industry was expedited through assistance rendered in obtaining the proper identification.

Seattle, Wash.

Livers from an adult male shark (Echinorhinus brocus), a female great blue shark, and from torpedo, bay, and blacktip sharks from the Pacific Explorer expedition were analyzed for vitamin A. A survey of sampling methods for seal oil was made.

* * *

Fish cookery was demonstrated before two groups of home economics teachers at an institute conducted at the University of Washington.

* * *

A staff member spent most of the month aboard a halibut vessel recording its operations in 16 mm. motion picture and 35 mm. still film.

* * *

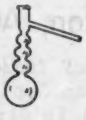
Tests were completed in Seldovia, Alaska, on the alkali digestion method for obtaining vitamin A oils from salmon cannery offal.

* * *

Determinations of the lysine content in salmon waste indicated that even low temperature drying destroys a perceptible amount.

* * *

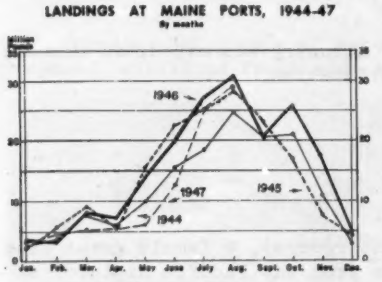
A large scale laboratory lyophilizer was constructed which will dry, in the frozen state, about 5 pounds of material at a single charge.



FRESH AND FROZEN FISH

New England

MAINE LANDINGS: Maine fishermen landed 28,284,000 pounds of fishery products, valued at $1,843,432, during August bringing the total for the first eight months of the year to 92,086,000 pounds, valued at $6,547,701, according to Current Fishery Statistics No. 372. This represents a decrease of 19 percent in volume and 20 percent in value as compared with the landings during the first eight months of 1946, which totaled 114,165,000 pounds, valued at $8,169,464.

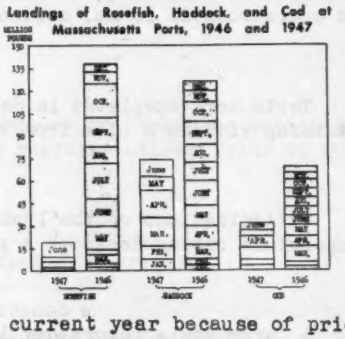


The importance of lobsters to the Maine fishing industry is indicated by the large portion of the fishermen's income that is derived from the sale of these shellfish. The August catch of lobsters -- 3,352,000 pounds -- valued at $1,081,775, accounted for 59 percent of the total amount received by Maine fishermen for their catch of fishery products during the month.

During August, landings at Portland amounted to 4,261,000 pounds, valued at $129,603 to the fishermen.

* * * * *

MASSACHUSETTS LANDINGS: Landings of fish and shellfish at the ports of Boston, Gloucester, New Bedford, Provincetown, and other Cape Cod ports during June amounted to 51,081,000 pounds, valued at $2,856,237 to the fishermen, according to Current Fishery Statistics No. 371. These landings brought the total for the first 6 months of 1947 to 191,200,000 pounds, valued at $14,243,301.



Landings at Boston during the first 6 months of 1947 amounted to 102,478,000 pounds--an increase of 108 percent over the same period in 1946, while receipts at Gloucester, which amounted to 43,357,000 pounds were 56 percent below the landings in the first half of 1946. Labor difficulties at Boston in 1946, and the curtailment of landings at Gloucester during the current year because of price declines were responsible for the variation in landings at these ports.

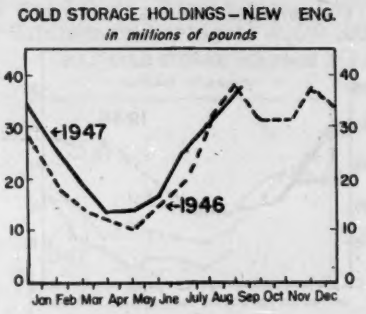
* * * * *

COLD-STORAGE HOLDINGS: Holdings of frozen fish and shellfish in New England warehouses totaled 36,468,000 pounds on September 1, according to the Service's Boston Market News Office. This area is divided into three sections: Boston, Gloucester, and "other than Boston and Gloucester." The holdings for the three sections were 18,617,000, 9,303,000, and 8,548,000 pounds, respectively.

Compared with the national holdings, New England's represent 24 percent of the total. The holdings for the area increased 28 percent over its total on Au-

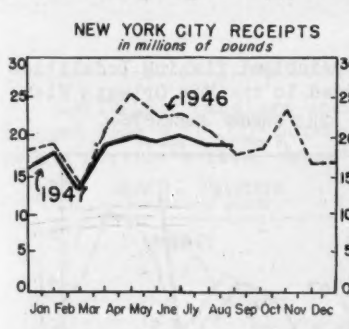
gust 1, while the national holdings increased but 15 percent. As a producing area, it was to be expected that during the summer period of high fish production relatively large increases in holdings would occur.

Although the holdings in this area are greater, there is a more even distribution of them than was the case last year. In 1946, it was necessary to curtail some of the fishing operations at Gloucester because the warehouses there were almost filled to capacity.



Middle Atlantic

NEW YORK CITY ARRIVALS: Receipts of fish and shellfish at the New York Fulton Market during August 1947 totaled 18,002,000 pounds, according to the Service's local Market News Office. This amount represents a decrease of about 200,000 pounds under total receipts for July 1947. Total receipts for August 1946 amounted to a little more than 17½ million pounds. Approximately 61 percent of the total for August 1947 was fish, and the remainder was shellfish.

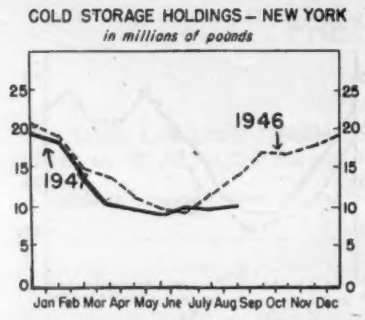


The more important species included scup, mackerel, flounder, cod, haddock, whiting, yellowtail, halibut, and salmon. Leading items in the shellfish group were hard clams, shrimp, sea scallops, lobsters, hard and soft crabs, and squid.

The market was generally sluggish for the entire month due in part to continuous hot and humid weather. All species of salt-water fish in good supply sold at prices close to or lower than the former OPA ceiling prices, while sales of a few species, such as scup, small mackerel, and whiting, barely covered the cost of boxes, ice, and transportation. The market for larger grades of hard clams was weak with many sales made at low prices for planting. Shrimp prices continued high for the jumbo and medium sizes, but averaged lower than those received during July. The demand for small shrimp was very light and quantities of small and medium shrimp were frozen during the month.

* * * * *

NEW YORK CITY COLD-STORAGE HOLDINGS: Cold-storage holdings of frozen fish and shellfish in the New York metropolitan area on August 28 were 8,958,000 pounds, 11 percent greater than the total of 8,088,000 pounds held on July 31, 1947, and 31 percent less than the 12,985,000 pounds in storage on August 29, 1946, according to the New York Fishery Market News Office. The six leading salt-water items were salmon, mackerel, halibut, cod and haddock fillets, and sablefish, and they accounted for 63 percent of the total of all salt-water species. The only important species which showed an increase in their holdings over 1946 are mackerel and had-

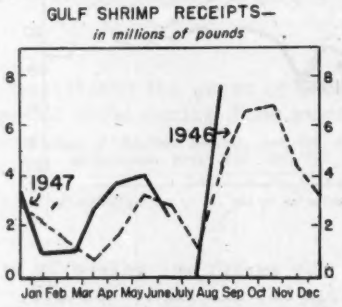


dock fillets. Cisco, whitefish, and sturgeon made up 68 percent of the fresh-water species; and shrimp, squid, and scallops, 73 percent of the shellfish group.

Holdings of warehouses in New Jersey reporting to the New York Office of the Market News Service, as of August 28th, were 2,855,000 pounds compared with a total of 3,394,000 pounds on August 29, 1946. The total August 28, 1947, includes 2,596,000 pounds of salt-water fish compared with 3,204,000 pounds on August 29, 1946, which is a decline of 19 percent and 260,000 pounds of shellfish, compared with 189,000 pounds on August 29, 1946, an increase of 37 percent. Holdings of butterfish, weakfish, ling, and scup show a sharp decline when compared with 1946.

Gulf

PRODUCTION: Landings of shrimp in August at the principal fishing localities in Alabama, Mississippi, Louisiana, and Texas as reported to the New Orleans Fishery Market News Office amounted to 7,500,000 pounds. This is greater than production during August of last year by 630,000 pounds. Louisiana production was slightly less, but in the other Gulf states, landings were greater than during August 1946. These greater landings were due, in part, to the fact that operations were not hampered this year as they were by the price dispute during August 1946. Although data for July 1947 were not collected, it is estimated that shrimp landings during this month did not exceed 6,000 barrels. The shrimp season for inside and outside waters of Mississippi and Louisiana, which had been closed June 10, opened August 11. In Alabama, the closed season opened August 16, for inside waters, and in Texas, inland waters opened for shrimping on September 1. There is no closed season in outside waters of Alabama and Texas. Landings for the first 8 months of this year are approximately 28 percent less than during the same period last year. Since the opening of the closed season, over half of the quantity of shrimp landed were reported to have been used for canning.



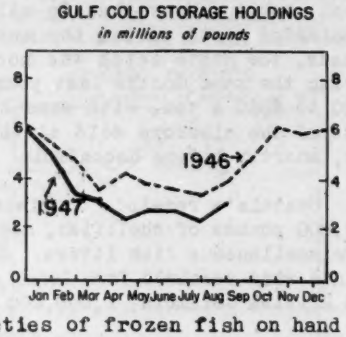
Oyster production continued to be low during the summer months. Landings in August were approximately 20 percent less than in August 1946. Landings for the 8 months of this year were, however, 35 percent greater than for the same period last year.

Landings of fish were greater than during August 1946. Alabama and Louisiana landings showed a reduction, but in Texas, production was greater. Most of the fresh fish production consisted of red snapper, catfish, mullet, and grouper.

Blue crab production increased 14 percent over landings in August 1946; yet the total for 8 months of this year is only slightly greater than one-half of the production during the same period in 1946.

* * * * *

COLD STORAGE: Eleven cold-storage warehouses in Alabama, Mississippi, Louisiana, and Texas reported frozen fish and shellfish holdings amounting to 2,671,000 pounds on August 28, 1947. This was 27 percent greater than those of 4 weeks previous and 32 percent less than on August 29, 1946, according to the Service's Market News Office in New Orleans.

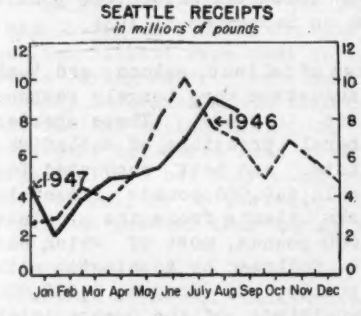


Frozen shrimp holdings amounted to 907,000 pounds, 550,000 pounds greater than 4 weeks earlier and 500,000 pounds less than one year ago.

Salt-water fish holdings on August 28 were 1,333,000 pounds, approximately 24,000 pounds less than 4 weeks ago and 775,000 pounds less than those of last year. At present, the varieties of frozen fish on hand in order of quantities of holdings are mullet, rosefish fillets, miscellaneous fillets, whiting and king whiting, blue runner, and Spanish mackerel.

Pacific

ARRIVALS: Landings and wholesale receipts of fishery products at Seattle dropped from 9,111,000 pounds in July to 8,341,000 pounds during August, according to the Service's local Market News Office. This decline of nearly 9 percent was caused, mainly, by a sharp drop in otter trawl operations. Local trawlers landed only 582,000 pounds of groundfish during August, the bulk being about 200,000 pounds each of petrale sole and rockfishes. Trawlers made 24 trips to the offshore grounds compared with 68 trips in July which produced 1,668,000 pounds. Individual vessel catches and truck deliveries from northern Puget Sound ports were relatively light and, in addition, there were a number of trawlers engaged in tuna fishing.



Salmon receipts totaling 1,979,000 pounds were 44 percent below July's deliveries. The late summer run of king and silver salmon, which are almost all taken by trollers, was under expectations and catches of these fish were spotty and infrequent. Prices for troll-caught salmon averaged about 12 cents a pound above 1946 ceilings.

The landings of halibut were heavy and despite the late start during this year's operations, the Seattle halibut fleet was able to take a fair portion of the Area 3 quota before the season ended. The local fleet making 77 trips to Area 3 and 9 trips to Area 2 landed over 3,775,000 pounds of halibut which were nearly three times the July landings. Additional halibut arrivals from Alaskan and Canadian sources raised the August total to a little over 4,739,000 pounds. Bidding was consistently brisk and prices averaged about 26 cents a pound for mediums and 23 cents for chickens and large. Incidentally, the season which closed on August 17, was the shortest on record, totaling 109 days.

August's albacore tuna catches were encouraging to fishermen and canners. Seattle's receipts amounted to about 85,000 pounds, much of which entered the fresh market. More than 2½ million pounds of albacore were landed at various Washington ports during the month. Coupled with July's landings of 1,268,000 pounds, the State catch was more than three times the 1,321,000 pounds landed during the same months last year. Prices for albacore were strong, ranging from $520 to $580 a ton, with some offers reported as high as $600 a ton. In 1946, most of the albacore sold at the $390-ceiling which was later raised to $410 a ton, shortly before decontrol.

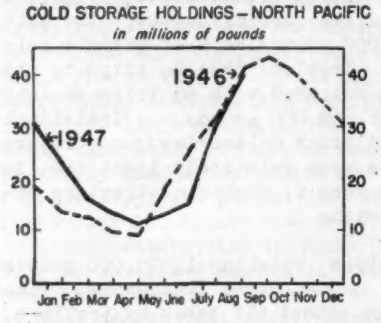
Seattle's receipts consisted of 7,708,000 pounds of fresh and frozen fish; 202,000 pounds of shellfish, mostly clams, crabs, and oysters; and 431,000 pounds of miscellaneous fish livers. More than two-thirds of all receipts or 5,894,000 pounds were received from local sources, with Alaska contributing 1,348,000 pounds, and British Columbia, 1,099,000 pounds.

During the first 8 months of 1947, Seattle's receipts reached a volume of 45,842,000 pounds, about 16 percent under the 54,582,000 pounds for the same period in 1946.

* * * * *

COLD STORAGE: Holdings of frozen fishery products in cold-storage warehouses of the northwest region totaled almost 39,250,000 pounds on September 1, according to the Service's Seattle Market News Office.

This was an increase of about 34 percent or more than 10,000,000 pounds over August 1. However, the holdings were about 7 percent below the 42,000,000 pounds held in the region on September 1, 1946.



Heavy freezings of halibut, salmon, and tuna continued during August and were largely responsible for the sharp increase. These species together with liberal freezings of sablefish, miscellaneous fillets, and bait accounted for 99 percent of the 14,649,000 pounds frozen in the region. Alaska plants froze the greatest bulk, over 8,000,000 pounds, most of which was halibut and salmon, followed by Washington with nearly 4,000,000 pounds, and Oregon, 3,000,000 pounds. About two-thirds of the Oregon total was albacore tuna.

Heaviest holdings were reported for halibut, 20,690,000 pounds; salmon, all species, 7,690,000 pounds; and tuna, 6,163,000 pounds. In addition, 1,718,000 pounds of sablefish; 1,045,000 pounds of miscellaneous fillets; and 699,000 pounds of bait and animal food were held in storage. These 6 items, totaling over 38,000,000 pounds, accounted for 97 percent of all holdings for the region.

Cured fish stocks, amounting to 5,377,000 pounds, continued to climb. This was about a third more than was held during the previous month. Slightly more than 4,500,000 pounds were mild cured salmon, practically all held in Seattle warehouses, pending shipment. Alaska plants were cleared of all cured stocks except a small quantity of salmon.

Great Lakes

RECEIPTS: Receipts of fresh and frozen fishery products in the Chicago wholesale market during August 1947 totaled 7,434,000 pounds, according to the Service's local Fishery Market News Office. This was a decline of 10 percent compared with July receipts and an increase of 18 percent over receipts during August 1946. Compared with July, fresh-water receipts declined 13 percent, but they were 14 percent greater than fresh-water receipts during August 1946. Salt-water arrivals declined 4 percent from July, but they were 34 percent above those of August 1946. Shellfish receipts were 28 percent below the July total and 15 percent below the shellfish arrivals during August 1946.

Chief reason for the decline in fresh-water arrivals was the greatly lessened supplies of chubs, lake trout, whitefish, and yellow pike. A factor also contributing to the general decline was the lighter supply of the slower moving rough fish items. Although receipts of whitefish from United States points were bolstered by arrivals from Canadian sources, chiefly Alberta, this species fell 43 percent below the July total. Yellow pike continued to arrive from Minnesota and Manitoba sources throughout the month, but the total was 4 percent below the July figure, while chubs fell 30 percent below July arrivals. Yellow perch, the only important fresh-water item registering a gain, more than doubled the previous month's production.

Halibut, most of it frozen and arriving late in the month, led all other items in the salt-water section showing a gain over July arrivals of 18 percent. Rosefish fillets were next in importance but this item fell 5 percent below arrivals during July. Decreases in other salt-water items such as cod, haddock, pollock, and whiting were the chief reasons that salt-water items showed a 4 percent decline during the month. Cod showed the largest decrease during the month, 55 percent below its July total. The other items mentioned did not show such large declines but they added to the general reduction. Salmon arrivals exceeded those of July by 76 percent, although the total poundage remained low. It was 81 percent greater than during August 1946.

Shellfish receipts reached their lowest point in the past two years, falling 24 percent below July deliveries and 15 percent below arrivals during August 1946. With the exception of scallops, all shellfish items of importance showed declines in receipts. Shrimp, always the leading shellfish item fell 29 percent below July arrivals and 32 percent below those of August 1946. Oysters making their first appearance of the new season arrived in negligible quantities, mostly in the shell.

Extended hot weather seriously affected the quality of some Great Lakes fish shipped during the month. Some shipments of fish arriving in Chicago, after only overnight trips, were dumped. Others were filleted or frozen as a salvaging expedient. Heavy icing at the point of origin was of little avail as most of the fish arrived in Chicago with little or no ice in the boxes.

Vacation season affected the demand for fishery products and the lack of demand was reflected by the stability of prices throughout the month.

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COLD STORAGE: Holdings of fishery products in Chicago cold-storage warehouses on September 4, 1947, amounted to 6,111,000 pounds, according to the Chicago Fishery Market News Office. This represents an increase of 8 percent over the total on July 31. Compared with the holdings on September 5, 1946, the current amount represents a decline of 10 percent.

Fresh-water holdings gained only 7 percent during a month which usually shows greater gains in holdings of fresh-water fishery products. Chief fresh-water items in storage were chubs, lake trout, and whitefish.

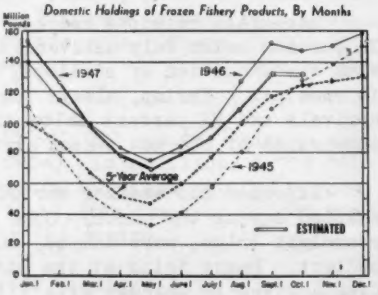
Leading item among salt-water holdings was halibut, this variety showed a gain of 82 percent during the month. Other leading items were fillets, which showed a gain during the month of 4 percent; salmon, all species, which showed a decline of 18 percent; and whiting, which showed a decline of 19 percent.

Shrimp led all holdings of shellfish with one of the lowest totals ever shown for this variety. The decline of shrimp holdings during August of 34 percent was an expected decline but the usual late August shipments of shrimp from the Gulf failed to materialize except for an infrequent LCL shipment. As a result, the total holdings of shrimp were rapidly nearing the vanishing point but September shipments were expected to send the total holdings upward again.

Halibut, as usual, remains the most controversial item on the local market. None of the dealers seem too anxious to acquire any unusual amount for holding purposes. Halibut is rapidly joining shrimp as an article purchased by dealers because it is a "must," one on which no profit can be made but a necessary commodity with which to attract purchasers of other items.

United States

COLD-STORAGE HOLDINGS AND FREEZINGS: Stocks of frozen fish and shellfish held on September 1st by firms reporting their activities to the Fish and Wildlife Service amounted to 132,930,000 pounds compared with 152,403,000 pounds on the same date in 1946, according to Current Fishery Statistics No. 364. Holdings destined for retail sale as frozen fish are somewhat less than the above figures indicate, since September 1st stocks of frozen tuna held for canning amounted to nearly 6.5 million pounds, compared with .4 million pounds on the same date last year.



CANNED AND CURED FISH

Pilchard

PILCHARD PACK AND BYPRODUCTS: The new pilchard (California sardine) season opened on an optimistic note as the production of 7,404 tons during August was 26 percent larger than the landings for the first month of the 1946 season, according to the California Division of Fish and Game and the California Sardine Products Institute. As was the case last year, fishing was restricted to the San Francisco and Monterey areas. Fishing was not permitted in the San Pedro area until October 1.

California Sardine Landings, Canned Pack and Byproducts

Item	Unit	MONTH 1947 August	MONTH 1946 August	SEASON 1947-48 August	SEASON 1946-47 August
Landings	Tons	7,404	5,861	7,404	5,861
		Aug.1-28,1947	Aug.1-29,1946		
Canned	1 lb. ovals-48 per case	45,424	26,425	45,424	26,425
	1 lb. talls-48 per case	29,223	26,902	29,223	26,902
	½ lb. fillets-48 per case	110	2,924	110	2,924
	¼ lb. round-96 per case	414	407	414	407
	Unclassified	39,139	2,986	39,139	2,986
	TOTAL, Actual Cases	114,310	59,644	114,310	59,644
		August	August		
Meal	Tons	872	781	872	781
Oil	Gallons	164,575	160,873	164,575	160,873

One result of the increase in landings was a substantial increase in the canned pilchard pack, which totaled 114,310 actual cases. Increases were also noted in the production of meal and oil, according to the same sources.

Salmon

SALMON PACK: The pack of Alaska canned salmon for the season to August 30, amounted to 3,845,370 standard cases, according to Alaska Salmon Pack Report No.

Alaska Salmon Pack to and including August 30, 1947

District	King	Red	Pink	Chum	Coho	Total
Western	13,792	1,352,570	2	40,955	345	1,407,664
Central	36,565	468,838	953,474	168,363	50,161	1,677,401
Southeastern	3,971	54,284	484,973	166,490	50,587	760,305
Total 1947, Aug. 30	54,328	1,875,692	1,438,449	375,808	101,093	3,845,370
All districts--						
1946, Aug. 31	31,755	1,038,647	1,378,785	455,745	133,348	3,038,280
1945, Sept. 1	37,108	1,166,510	2,211,966	678,334	155,577	4,249,495
5-year average, Sept. 1 1942-46, inclusive	38,000	1,331,364	2,140,183	762,616	159,948	4,432,111
Total pack, 1946	31,874	1,040,747	2,041,636	581,763	184,088	3,880,108
" " , 1945	42,514	1,177,523	2,239,643	689,001	201,790	4,350,471
5-year average, 1942-46, inclusive	42,219	1,339,307	2,305,352	819,212	219,465	4,725,555

10 issued by the Seattle Office of the Market News Service. This pack, although over 800,000 cases more than that for the same period last year, is approximately 600,000 cases short of the average for the 5 preceding years. The factor responsible for the considerable increase was the pack of red salmon, as the gains made in the packs of kings and pinks were more than offset by the lower packs of chums and cohoes.

Shrimp

SHRIMP PACK: The season for fishing for shrimp in the inside and outside waters of Louisiana opened on August 11. Shrimp fishing in these waters had been prohibited, starting on June 10.

The pack of canned shrimp, by those plants under the Seafood Inspection Service of the U. S. Food and Drug Administration for the new season to August 30 amounted to 38,192 standard cases, only 65 percent of the pack on the corresponding date last year. It also fell far short of the average pack for the three previous years.

Wet and Dry Pack Shrimp in all Sizes in Tin and Glass--Standard Cases*

MONTH		SEASON		3-year average 1944-47 seasons incl.
1947 July 1-Aug.30	1946 July 1-Aug.31	1947-48 July 1-Aug.30	1946-47 July 1-Aug.31	July 1-Aug.31
38,192	58,406	38,192	58,406	60,319

*All figures on basis of new standard case--48 No. 1 cans with 7 oz. per can in the wet pack and 6½ oz. per can in the dry pack.

Tuna and Mackerel

TUNA AND MACKEREL PACK: During August, 776,647 standard cases of tuna were produced by California tuna packers, according to the California Division of Fish and Game. Although this was almost 62,000 cases less than the July pack, it was

California Pack of Tuna and Mackerel--Standard Cases*

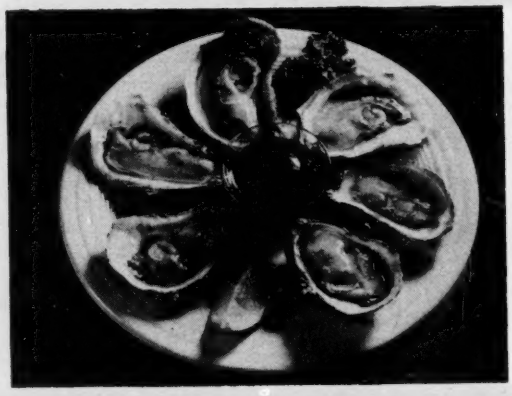
Item	August 1947	July 1947	August 1946	Eight mos. ending with August-- 1947	1946
	Cases	Cases	Cases	Cases	Cases
Tuna:					
Albacore	143,301	53,800	143,984	204,019	326,571
Bluefin	125,268	35,193	54,073	213,380	290,731
Bonito	39,458	151,938	25,327	220,741	30,576
Striped	131,676	107,127	97,327	501,119	340,128
Yellowfin	167,989	363,975	74,069	1,934,926	1,484,169
Yellowtail	43,253	16,655	7,235	78,335	34,665
Flakes	119,433	108,520	92,817	611,590	644,842
Tonno	6,269	1,410	-	19,280	-
Total	776,647	838,618	494,832	3,783,390	3,151,682
Mackerel	33,608	9,175	2,428	259,716	57,337

*Standard cases of tuna represent cases of 48 7-ounce cans, while those of mackerel represent cases of 48 1-pound cans.

57 percent greater than the pack of August 1946. The pack of albacore this year was almost the same as that of last year, but substantial gains in the packs of bluefin, striped, and yellowfin tuna, together with yellowtail, accounted for most of the increase this year. Normally, the pack during August is greater than that of July, but for the past 2 years, the reverse has been true.

The pack of 33,608 standard cases of mackerel during August makes this year's total more than 4½ times that for the corresponding period in 1946.

OYSTERS ON THE HALF-SHELL



36 shell oysters

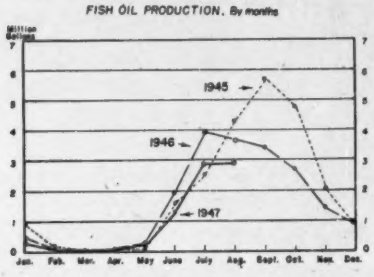
3/4 cup tomato catsup
1/4 cup lemon juice
3 tablespoons minced celery
1/3 teaspoon salt
6 drops tobasco sauce
dash cayenne

Shuck oysters. Combine all remaining ingredients for cocktail sauce and chill. Arrange a bed of crushed ice in shallow bowls or soup plates. Place six half-shell oysters on the ice with a small container of cocktail sauce in the center. Garnish with lemon wedges. Serves 6.

FISHERY BYPRODUCTS

Oil and Meal

PRODUCTION: The production of fish oils in the United States and Alaska during August amounted to 2,907,467 gallons--21 percent below the yield in the same month of 1946, according to Current Fishery Statistics No. 369. The production of oil was considerably below normal because of the second successive failure of the pilchard fishery in the San Francisco and Monterey districts of California. In the years from 1941 to 1945, inclusive, the average August catch of pilchards in these districts amounted to 50,888 tons compared with 5,861 tons in 1946 and 7,404 tons in August of this year.



During August, the production of meal by firms which normally produce 94 percent of the total yield of this product amounted to 33,178 tons compared with 31,387 tons in August of 1946. The relatively high yield of meal compared with the production of oil resulted from the reduction of large catches of menhaden which had a low oil content.

PRODUCTION OF FISH MEAL AND OIL, AUGUST 1947

Fish Meal and Scrap[1]

Product	August 1947	August 1946	Eight months ending with August 1947	Eight months ending with August 1946	Total 1946
Meal and scrap:	Tons	Tons	Tons	Tons	Tons
Groundfish	2,050	1,837	11,177	14,621	20,553
Herring, Alaska	3,300	2,650	7,262	10,670	14,989
Menhaden[2]	23,819	24,205	74,731	69,859	97,238
Pilchard (sardine)	1,793	1,498	6,408	7,225	35,623
Tuna and mackerel	2,216	1,197	10,426	7,549	12,256
Total	33,178	31,387	110,004	109,924	180,659

1/Data are preliminary and subject to revision.
2/Includes a small quantity of herring meal produced in Maine.
Note: Data on the yield of fish meal and scrap are based on items which normally account for about 94 percent of the total production. Since cumulative totals are revised monthly, they may not agree with totals previously published.

Fish Oils[1]

Product	August 1947	August 1946	Eight months ending with August 1947	Eight months ending with August 1946	Total 1946
Oil:	Gallons	Gallons	Gallons	Gallons	Gallons
Groundfish	48,711	29,681	98,734	166,359	301,136
Herring:					
Alaska	847,445	578,800	1,902,676	2,456,193	3,444,893
Maine	14,135	15,282	55,288	28,813	87,037
Menhaden	1,602,047	2,589,094	4,709,025	6,681,457	9,891,614
Pilchard (sardine)	302,755	353,837	535,542	787,924	4,741,689
Tuna and mackerel	63,016	54,622	282,720	191,074	367,667
Other	29,358	39,562	123,877	151,996	232,953
Total	2,907,467	3,660,778	7,707,862	10,463,816	19,066,989

1/Does not include the production of fish liver oils. Data are preliminary and subject to revision.
Note: Data on the production of pilchard and tuna and mackerel meal and oil in California were furnished by the California Division of Marine Fisheries.

OTHER FISHERY NOTES

Additions to the Fleet of U.S. Fishing Vessels

A total of 143 vessels received their first documents as fishing craft during August 1947, compared with 134 in the same month the previous year. The State of Louisiana led with 20 vessels documented during the month, followed by Washington with 17 vessels, and North Carolina with 16 vessels, according to information received from the Bureau of the Customs, Treasury Department. Of the 924 vessels documented during the first eight months of 1947, Washington led with 188 vessels, 95 were from California, and 80 from Louisiana.

Vessels Obtaining Their First Documents as Fishing Craft

Section	August		Eight mos. ending with August		Twelve Months
	1947	1946	1947	1946	1946
	Number	Number	Number	Number	Number
New England	6	7	58	47	86
Middle Atlantic	8	12	50	43	74
Chesapeake Bay	8	9	68	45	71
South Atlantic and Gulf	66	46	316	205	351
Pacific Coast	32	43	318	293	375
Great Lakes	13	10	59	57	76
Alaska	4	1	25	17	19
Hawaii	5	3	18	7	17
Unknown	1	3	12	13	16
Total	143	134	924	727	1,085

Note: Vessels documented by the Bureau of the Customs are craft of 5 net tons and over.

Krug Urges More Fish for Use on Two Meatless Days

Secretary of the Interior J. A. Krug announced on October 7 that he was urging the fishing industry to see that good supplies of fish and other seafoods are available in markets throughout the country on Tuesdays and Thursdays as well as on the traditional Friday fish-day.

President Truman has asked the nation to forego meats on Tuesdays and poultry and eggs on Thursdays in order to conserve food supplies.

"The fishing industry has always made special efforts to see that good supplies of fish in many varieties have been available for Friday use," Secretary Krug said. "From now on we are expecting the industry to make an equal effort to see to it that plenty of fish and other seafoods are available on the new meatless and eggless days. The industry has always sought to persuade housewives to use fish on days other than Friday and will welcome its present opportunity."

He also said that the Fish and Wildlife Service would join the industry in encouraging more retail stores to install adequate equipment for the handling of fishery products.

"The fishing industry is one of the few important elements in the food field that is capable of rapidly expanding its production at the present time. Literally millions of pounds of nutritious fish will be made available by the industry as soon as needed."

The Secretary said that he also had instructed the Fish and Wildlife Service to begin a campaign to teach housewives how to use fish economically.

Suggestions offered by the Service are:

Where to buy: Select a reliable market or store with facilities for handling fish adequately. Fresh fish should be well iced in the displays and frozen fish should be solidly frozen.

What to buy: For economy, look for items in abundant supply or for local or lesser known varieties of fresh fish; compare fresh and frozen fish prices. Fillets and steaks are economical because they have little waste and generally involve little cleaning or other preparation to make them ready for the pan.

Modern methods of refrigeration make possible the preparation of frozen products with flavor equal to that of fresh fish. Foods frozen while in prime condition and kept properly refrigerated, retain their fine, full flavor after defrosting.

How to select: The homemaker who buys fish only occasionally may have difficulty in accurately appraising quality and therefore must depend, to some extent, on the judgment of the retailer. Little trouble should be experienced in distinguishing between the various stages of freshness if the following factors are observed:

1. Whole fish, as a rule, should be rigid and flesh should be firm.
2. Odor should be mild and pleasant.
3. Eyes should be clear and full.
4. Gills should be reddish or pink in color.
5. Skin should be shiny and the color unfaded.
6. Frozen fish should be in a solidly frozen condition. There should be no trace of browning or dried-out appearance.

How to prepare: Many retailers make a practice of providing tasty recipes for the preparation of fish. Ask for such information. Follow cooking directions closely. It is important that fish be given its proper cooking time. Do not overcook.

Cuts of fish: Clerks are sometimes helpful in advising the better cuts for particular cookery, aiding in good selection, and suggesting good buys. Most retailers will prepare the fish in the form required for cooking. Buy your fish so there will be the least work for you in the kitchen. Fish may be obtained in the following forms:

Whole or round--fish as caught (Allow 1 pound per person)

Drawn--entrails only are removed (Allow 3/4 pound per person)

Dressed--entrails, head, tail, and fins are removed
(Allow 1/2 pound per person)

Pan-dressed--prepared as above, perhaps split, ready for the pan (Allow 1/2 pound per person)

Fillets--side of fish cut away from bone, practically boneless (Allow 1/3 pound per person)

Steaks--cross sections of large fish (Allow 1/3 pound per person)

Chunks--thicker portions than steaks (Allow 1/3 pound per person)

How to handle in the home: Fish is a perishable item. Wrap in moisture-proof paper and place it in the refrigerator until time for preparation.

Do not allow fish, either fresh or frozen, to stand in water. If fish must be washed, do so quickly by dipping in cold water. Dry or drain immediately.

Frozen fish should be placed in the freezing unit of the refrigerator. To thaw, place it in the warmer section of the refrigerator or expose to room temperature. Frozen foods may be cooked without preliminary thawing if additional cooking time is allowed.

Motion Picture on Retailing Fish

Improvement in fish retailing practices in the average store is the objective of a motion picture titled "Retailing Fish" being produced by the Fish and Wildlife Service under its program of market development. The subject was selected because of its importance in the field of marketing fishery products. Better retailing practices will do much to provide for increased consumer acceptance of products of the fisheries.

SHOOTING "RETAILING FISH"

An instructional movie, the film depicts the handling and merchandising of fresh and frozen fishery products. Such factors as methods of selecting, icing, and handling fish; cleanliness and sanitation; and display and merchandising receive particular emphasis. Representative scenes adaptable to the average retail outlet are to be shown.

The writing of the script and selection of location are under way. Present plans call for the shooting of major sequences of the film in a super market in Philadelphia. Others will be taken in a Brooklyn, N. Y., retail fish store, and in a White Plains, N. Y., frozen food market. Shooting is planned for completion by the end of October with editing of rushes and fitting of commentary to film to be finished sometime in December. Prints of the film are expected to be available for distribution sometime in February 1948.

Although directed primarily at retail operations, this film will be of interest to consumers as well as members of the fishery industry because it shows in an interesting manner the operations in a well-run market. It also impresses the need for adequate care and handling of the product all along the line, from producer to retailer. Wholesale dealers and distributors may obtain from this picture a realization of the importance of efficient retailing in the chain of fish distribution.

The film is in 16 mm. sound and color and runs about 20 minutes. Arrangements for scheduling this film for private showing can be made by writing to U.S. Fish and Wildlife Service, Department of the Interior, Washington 25, D. C. Copies will be available for distribution sometime in February.

Synthetic Vitamin A

U. S. SYNTHETIC VITAMIN A: Synthetic vitamin A has been prepared in pure crystalline form as the alcohol, and as the acetate and anthraquinone carboxylate esters, according to an abstract of a paper presented by Cawley, Robeson, Weisler, Shantz, Embree, and Baxter at the American Chemical Society meeting, New York City, on September 15. The crystalline alcohol melted at 61°-62° C., the same as a sample of material prepared from natural sources; and a mixed melting point showed no depression. The synthetic acetate melted at the same temperature as natural vitamin A acetate: 57°-58° C. The anthraquinone carboxylate melted at 121°-122° C., the same as the corresponding ester of the natural vitamin.

The crystalline synthetic alcohol had an extinction coefficient of 1800 at 325 mmu., compared with 1780 for the natural vitamin. The ultraviolet absorption curves are nearly superimposable. The synthetic acetate was also identical with the acetate of natural vitamin A.

The infrared spectra of the synthetic and natural vitamins were also closely similar. The blue colors formed by treatment of the two materials with antimony trichloride seem to be identical.

The biological assays of the crystalline synthetic material against crystalline natural vitamin A and its acetate showed it to be fully equal in potency.

It has been shown that the synthetic material contains neovitamin A in about the same ratio as has been found in fish liver oils.

It was reported that pilot plant work has been in progress and it is expected that experimental samples will be available shortly. The material will be made available commercially in oil solution, at high potencies, probably in the form of the acetate ester, and probably at a concentration of 1,000,000 U.S.P. units per gram.

The producing corporation, Distillation Products, Inc., Rochester, N. Y., has stated that it is a little early to make any statements that fish liver oils will be replaced completely, and that it will be some time before its production will be sufficient to supply even a part of the potential demand for vitamin A; however, it is moving in the direction of early production.

The corporation hopes to make synthetic vitamin A available at prices generally comparable to distilled vitamin A ester concentrates, but production problems and yield behavior will determine that important point.

* * * * *

DUTCH SYNTHETIC VITAMIN A: The successful synthesis of vitamin A was announced by the Organon Pharmaceutical Laboratories, Oss, Holland, according to "Aneta" news agency. The agency report said that a variety of tropical grass, abundant in Indonesia and Australia, serves as the raw material for the synthetic vitamin, but added that the company had warned against premature expectation of large supplies of it in the near future.

National Resources and Foreign Aid

National Resources and Foreign Aid, a 97-page report by Secretary Krug of the Department of the Interior, contains in Part III, under "Commodity Summaries," the following resumé of the situation with respect to fishery products:

> The production of fish and shellfish in 1947 is estimated at 4.4 billion pounds. Of this yield about 3 billion pounds will be used to produce commodities for human consumption (a portion of this amount is waste material). The remainder will be used for the manufacture of industrial products, principally fish oil and fish meal.
>
> Imports are estimated as amounting to 500 million pounds (round weight basis). Changes in inventories of fish will be negligible. Exports are estimated as amounting to 220 million pounds edible weight or about 440 million pounds round weight.
>
> A foreign-aid program would not noticeably affect imports since imported fish are largely "specialties" which have a specific and continuing market. Similarly, such a program is not expected to affect exports. European fish production is practically back at prewar levels in the major fish-producing countries, and surpluses amounting to above 480 million pounds for 1947 are available in Norway, Denmark, Iceland, and the United Kingdom. Exports usually occur in canned fish products and are a relatively expensive source of calories. Moreover, a substantial increase in canned fish exports, suddenly effected during the coming year, would reduce the per capita consumption of fish in the United States at a time when domestic fish consumption should be increased if meat consumption is to be reduced to conserve grains for export. However, if the canning of less popular species, such as rockfish, silver, hake, Maine herring, or mullet is increased and the product exported, domestic consumption would not be greatly affected.
>
> In order to provide fishery products for European nations requiring greater supplies of protein food, fish

surpluses could be diverted from the northern European countries, and gear and processing equipment could be furnished to countries whose fishing industries were destroyed by the war. Germany, for example, produced about 1.6 billion pounds of fish annually before the war. Less than 40 percent of that production has been restored.

Domestically, fish waste and byproducts could be used in increased quantities for the purpose of animal and poultry feeding. Fish protein is substitutable in part for vegetable protein, and its increased use for animal and poultry feeding would reduce domestic consumption of grains needed for export.

Facilities exist for a substantial increase in the production of fish waste and byproducts. However, increased production is dependent upon the size of the runs of pilchards and menhaden. In recent years the runs of pilchards on the west coast have been much below average. Any return to favorable conditions would provide larger supplies of fish meal and fish oil for feed.

The United States is on a net import basis with respect to fish oils used for pharmaceutical purposes, and imports of these products could be increased.

TABLE 12.—*United States exports, by continents*

EDIBLE AND NONEDIBLE FISHERY PRODUCTS

Continent	1936–38 average		1947—first 6 months [1]	
	Amount	Percent of total	Amount	Percent of total
North America	$2, 219, 040	15. 73	$3, 781, 760	12. 85
South America	692, 371	4. 91	1, 422, 436	4. 83
Europe	8, 836, 049	62. 65	19, 095, 923	64. 91
Asia	1, 455, 446	10. 32	4, 518, 017	15. 36
Oceania	320, 091	2. 27	122, 792	. 42
Africa	581, 614	4. 12	479, 771	1. 63
Total	14, 104, 611	100. 00	29, 420, 699	100. 00

[1] Excludes a relatively small amount of inedible fish products.

NOTE.—Source: Foreign Commerce and Navigation of the United States, U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce (1936-38 Yearbooks) and 1947 preliminary publications.

TABLE 13.—*United States production, exports, and imports*

FISH PRODUCTS

[In thousands of dollars]

Year	Production	Exports	Imports
1919	(1)	(2)	(2)
1920	(1)	(2)	(2)
1921	(1)	(2)	(2)
1922	(1)	(2)	(2)
1923	(1)	(2)	(2)
1924	(1)	20, 850	46, 399
1925	(1)	21, 263	49, 031
1926	102, 902	20, 329	50, 095
1927	112, 724	18, 717	55, 634
1928	116, 384	21, 174	58, 855
1929	123, 054	23, 830	60, 566
1930	109, 349	17, 276	50, 830
1931	77, 344	11, 574	43, 033
1932	54, 764	7, 808	29, 566
1933	60, 218	8, 339	30, 462
1934	74, 163	13, 822	30, 790
1935	80, 121	14, 374	36, 232
1936	92, 823	13, 331	41, 873
1937	100, 845	14, 567	50, 636
1938	93, 547	14, 415	39, 307
1939	96, 532	14, 207	45, 999
1940	98, 957	17, 785	41, 830
1941	134, 172	22, 008	40, 981
1942	170, 338	31, 989	39, 629
1943	204, 000	45, 830	67, 231
1944	207, 300	33, 209	[3] 68, 761
1945	230, 941	34, 183	[3] 87, 785
1946	253, 000	40, 887	[3] 103, 744
1947 [4]	[5] 260, 130	(6)	(6)
1948 [4]	[5] 265, 147	(6)	(6)
1949 [4]	[5] 270, 245	(6)	(6)
1950 [4]	[5] 275, 430	(6)	(6)
1951 [4]	[5] 280, 703	(6)	(6)
1952 [4]	[5] 286, 068	(6)	(6)

[1] Not available.
[2] Available in Foreign Commerce and Navigation, U. S. Department of Commerce.
[3] Excepts a relatively minor amount of miscellaneous fishery products.
[4] Estimates.
[5] Estimated on basis of 1946 average price for fish and shellfish.
[6] No estimates of these items were given.

NOTE.—Source: Fish and Wildlife Service, Department of the Interior. Production—export and import series for fish are not available on a uniform weight basis. Data given are on value basis.

The report may be obtained for 60 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Catch in TVA Lakes Increases

The commercial fish catch in TVA lakes was higher for fiscal year 1947 which ended June 30, than for the previous year, according to figures released by TVA in the September-October 1947 issue of the Tennessee Conservationist.

The Chief of TVA's Fish and Game Division reports that the 1947 catch of nongame fish was 1,550,000 pounds as compared with 1,183,500 pounds for the year before.

"Fishermen's incomes for the two seasons were $299,667 and $207,300, respectively. These are not estimates, but actual purchases reported by commercial fish buyers. The total catch, including fish used by the fishermen or sold direct to consumer, is much greater. Including the mussel crop, which last year was valued at close to $500,000, the total annual commercial harvest from TVA waters is estimated at $1,000,000.

PICKWICK LANDING DAM - TVA

"The 1947 catch included 808,165 pounds of catfish, 209,150 pounds of buffalo, 148,190 pounds of carp, 217,180 pounds of spoonbill, and 86,315 pounds of drum and sturgeon. More than a million pounds came from Alabama lakes alone. Based on pre-impoundment studies, this is at least a sixfold increase over the poundage taken from the Alabama section of the Tennessee River before the dams were built. Practically all fish taken in TVA waters are utilized locally, except spoonbill, which is shipped to New York markets.

"Commercial fishermen use different types of gear for different species. Carp and buffalo are taken mainly in nets. Most of the catfish and spoonbill are caught on snag lines. Baited set lines are also used. Snag lines differ from set lines in that more hooks are used and they are not baited; fish are hooked in the body, not in the mouth.

"Predictions that construction of dams on the Tennessee River would ruin mussel beds and deprive pearl button manufacturers of one of their best sources of shells have proved unfounded. The total mussel-shell harvest for 1946 was 9,200 tons valued at $500,000. This is roughly three times the 1945 tonnage and only 200 tons short of the all-time high production of 1942. Ninety percent of the 1946 production came from Kentucky Reservoir. Since extensive shell beds were discovered last year in Pickwick, Wheeler, and Guntersville reservoirs, production from the Alabama section of the river will no doubt increase in the future. Since more musselmen are now operating on the river, the 1947 tonnage is expected to exceed that for 1946."

Will Develop Hawaiian Fishing Industry

Secretary of the Interior J. A. Krug announced on September 23 that two experts of the Fish and Wildlife Service will begin preliminary discussions in Hawaii early next month on a program for the development of the high seas fishing industry in the South Pacific. Officials of the Territorial Government will participate in the discussions.

The program, authorized by the last Congress, is expected to stimulate the development of the Hawaiian commercial fishing which, in the view of officials, has great potentialities.

Milton C. James, Assistant Director of the Fish and Wildlife Service, and Dr. H. J. Deason, Chief of the Office of Foreign Activities, will represent the Department at the Hawaii conference.

Prior to the war, Japanese nationals controlled the offshore fishing industry in Hawaii and other Pacific islands. Because of this, the Federal Government must start practically from scratch to develop the offshore industry for the benefit of the residents of the Islands. The Act, which was sponsored by Delegate Joseph R. Farrington of Hawaii, authorizing the Department of the Interior to undertake the Hawaiian program, directs the Fish and Wildlife Service in cooperation with Territorial and Island officials to conduct explorations, technological, and economic studies to insure the maximum development and utilization of the fish resources of the Islands.

No appropriation was provided for in the Act and budget requests will be submitted at the next session of Congress.

The legislation provides for the construction of a fishery research laboratory and experiment station in the Hawaiian Islands and for the necessary substations, together with dock and storehouse facilities to be used in conjunction with the operation of research and experimental fishing vessels. It also provides for the procurement of three surplus vessels, a multiple purpose high seas fishing and oceanographical research vessel, and two experimental high seas fishing vessels, and for their conversion and equipment.

From Honolulu, Mr. James and Dr. Deason will proceed to Manila to inspect the progress made by the Fish and Wildlife Service experts who were assigned to the Philippine Fishery Rehabilitation Program early this year.1/

Committee of European Economic Cooperation

The results of the work of the Committee of European Economic Co-operation have been published by the State Department in two volumes. The first volume, General Report, is Publication 2930, European Series 28.

The second volume, entitled Technical Reports, is Publication 2952, European Series 29. It contains considerable information on European fishery production, import requirements, and exportable surpluses. Copies of these reports may be obtained from Division of Publications, Office of Public Affairs, the Department of State, Washington 25, D. C.

Japanese Economy

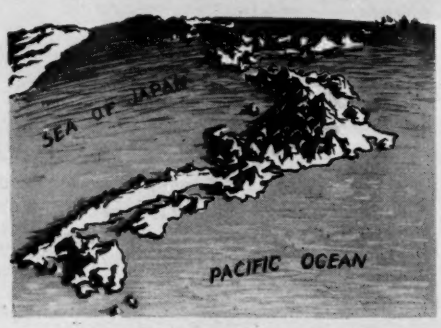
An idea of the important part that food plays in shaping civilization may be gleaned from the following excerpts taken from Weekly Summary of the Natural Resources Section, No. 96, of the Supreme Commander for the Allied Powers in Japan.

So important has been the need for food, particularly fish, on the part of Japan that Supreme Headquarters is giving it No. 1 priority in its effort to make Japan economically self-sustaining.

The Problem: War or Democracy? Beginning in 1875, Japan continuously expanded her activities in the search of raw materials. Six wars in 50 years netted

1/See "FWS Vessels Depart for Philippines," Commercial Fisheries Review, July 1947, pp.34-5.

marked increases of supplies. Each time, the nation obtained more food and raw materials for its crowded population. Formosa in 1895 meant sugar, camphor, petroleum, rice, and fish. Karafuto in 1905 meant wood pulp, fish, petroleum, and coal. Korea in 1910 meant rice, fish, cotton, and minerals. Manchuria in 1932 meant, beans, coal, steel, and chemicals. These facts tell us that Japan may go to war again unless we can make her self-sustaining and democratically inclined. If the people of future Japan continue to suffer from hunger and cold and continue to lack clothing and decent housing facilities, democratic institutions will be a mockery.



Solution of the Problem: An important part of our effort is directed toward making Japan economically self-sustaining. We are striving to increase the capacity of domestic natural resources for satisfying Japanese needs. At present, we are following three approaches toward this end;

(1) Maximizing the immediate production of food and raw materials;

(2) Promoting more effective use of materials;

(3) Insuring maximum long-range production of natural resources.

Japanese fishery production within the authorized area has now been brought to a level equal to, or greater than, prewar production in the same waters. Efforts are being made to increase production still further. However, the maintenance of the fishery at even the present level will be at the expense of future production. We are therefore commencing studies of fish population and fishing effort in critical areas. In this way we hope ultimately to determine the type of management needed for maximum long-term production.

State Department Increases Fishery Staff

The Department of State announced on September 18 the appointment of Robert W. Tyson, formerly of the Department of Agriculture, to the Fisheries and Wildlife Branch, International Resources Division. Mr. Tyson is being added to the staff of the Fisheries Branch primarily to carry out the instructions of the Congress in its appropriation of $25,000 to initiate an international fishery conservation program for the Northwest Atlantic Ocean.

Army Fish Purchases

Purchases of fish, exclusive of canned fish, by the Army Quartermaster Corps' 12 market centers from January to August, inclusive, have been as follows:

February - 1,046,459	April - 968,765	June - 993,738	August - 1,162,716
March - 1,802,210	May - 1,280,673	July - 787,763	

These purchases are in line with the expectations that the Quartermaster Corps had earlier in the year, that their purchases would average about a million pounds per month.

Purchases of Fish by Department of Agriculture

Purchases of fishery products by the U. S. Department of Agriculture during August amounted to 117,957 cases with a value of $361,466. The purchases followed the pattern of August 1946, in that they were confined mostly to the less expensive varieties of fishery products.

Purchases of Fishery Products by USDA

Commodity	Unit	August 1947		July-August 1947	
		Quantity	F.O.B. Cost	Quantity	F.O.B. Cost
FISH			Dollars		Dollars
Hake, canned	Cases	20,838	62,514	20,838	62,514
Herring, "	"	60,321	165,644	60,321	165,644
Mackerel,"	"	36,798	143,309	36,798	143,309
Total	"	117,957	361,467	117,957	361,467

Wholesale and Retail Prices

Prices of foods rose 3.3 percent and agricultural products, 2.0 percent from June to July, reaching levels only slightly below their March peaks and 1½ to 2 times more than August 1939, according to the Bureau of Labor Statistics, U. S. Department of Labor.

The family food bill in 56 cities advanced 1.4 percent between mid-June and mid-July, according to the same source. Higher prices for eggs, dairy products,

Wholesale and Retail Prices

Item	Unit		Percentage change from--	
Wholesale: (1926 = 100)		July 12,1947	June 14,1947	July 13,1946
All commodities	Index No.	148.3	+0.5	+22.9
Foods	do	165.8	+2.1	+23.7
Fish:		July 1947	June 1947	July 1946
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	3.817	+24.0	+76.0
Red, No. 1, Tall	do	5.656	+ 3.0	+39.0
Cod, cured, large shore, Gloucester, Mass.	$ per 100 pounds	13.50	0	0
Herring, pickled, N. Y.	¢ per pound	12.00	0	0
Salmon, Alaska, smoked, N. Y.	do	35.00	0	0
Retail: (1935-39 = 100)		July 15,1947	June 15,1947	July 15,1946
All foods	Index No.	193.1	+1.4	+16.5
Fish:				
Fresh and canned	do	260.6	+2.3	+10.8
Fresh and frozen	¢ per pound	38.1	+2.8	- 3.9
Canned salmon:				
Pink	¢ per pound can	41.6	+1.2	+63.8
Red	do	1/	-	-

1/Discontinued pricing July 1947

and meats were the chief factors in the rise over the month. Between March and July, the rise in food prices averaged 1.9 percent, which is approximately equal to the usual seasonal increase over this 4-month period.

The index for fresh and canned fish, during the month, showed an increase of 2.3 percent.

The retail pricing of canned red salmon was discontinued during July.

CHINCOTEAGUE - A NATIONAL WILDLIFE REFUGE

The famous shellfish country of the eastern shore of the Chesapeake surrounds the Chincoteague Wildlife Refuge. Chincoteague oysters have a widespread reputation for quality; perhaps the fact that they grow in water that is almost as salty as the open ocean accounts for their distinctive flavor. Although the region is best known for its oysters, clamming, carried on throughout the year, probably brings a larger income to local fishermen than the oysters do.

The establishment of a wildlife refuge has not interfered with the use of the area for shellfishing. The refuge itself contains about 250 acres of shellfish grounds. These consist of a narrow strip of flats between the tide lines, running in a long arc around the inside of Assateague Anchorage, and bordering the channel between the islands.

About 184 acres of these grounds are under cultivation. Before the refuge was established, the shellfish area was leased from the former owner of the property. It is now leased from the United States Government. One-fourth of the rental is paid to Accomac County, in which the refuge lies. The balance goes into the United States treasury.

--Conservation in Action, No. 1

FOREIGN FISHERY TRADE

Imports and Exports

GROUNDFISH IMPORTS: Imports of groundfish, including rosefish fillets, during August amounted to 2,052,918 pounds, according to preliminary figures released by the Bureau of Customs, U. S. Treasury Department. This was less than two-thirds of the total for the corresponding month last year. Iceland, with a total of 119,250 pounds, was the only source country to show an increase over August 1946. The total of 16,032,127 pounds for the year to the end of August is less than one-half that for the first eight months of 1946. This is the eighth straight month that the cumulative total for 1947 has been less than half that of the corresponding period in 1946.

Country	1947		1946	
	August	8-month Total	August	8-month Total
	Pounds	Pounds	Pounds	Pounds
Canada	1,624,608	12,305,025	2,116,742	26,168,808
Newfoundland	309,060	2,663,380	1,120,871	3,959,811
Iceland	119,250	1,063,722	10,000	3,018,184
Norway	-	-	-	1,756
Total	2,052,918	16,032,127	3,247,613	33,148,559

Africa

RESEARCH INSTITUTE REPORT: The Fishing Industry Research Institute, located at Cape Town, has recently issued its first quarterly bulletin for members. There follow excerpts from this bulletin:

The Institute was established as a result of negotiations between representatives of the fishing industry and the South African Council for Scientific and Industrial Research. It is, in fact, the first official industrial research association to be established in South Africa by the C.S.I.R.--and probably the first official, Government sponsored and subsidized, fishing industry research association to be formed in the world.

The contributions of the industry are made on the basis of annual gross turnover, according to a scale agreed upon by the representatives. The member firms are stated to represent over 90 percent of the industry. The Council subscribes to the funds of the Institute on a £ for £ basis, and has one representative on the Board of Control. The policy and activities of the Institute however, are controlled by the representatives of the fishing industry.

The Government exercises no control over the precise way in which the funds of the Institute are used, nor does it need to approve of the programmes of research of the Institute. The general condition attaching to the Government grant is that it is used for the prosecution of research. The Association is being incorporated

as a non-profit company. The results of investigations are the property of the members of the Association.

The Board of Control comprises tenmembers representing the following activities: private enterprise, the Fisheries Development Corporation, the C.S.I.R., the Division of Fisheries, the University of Cape Town, and the University of Stellenbosch. The Director of Research is Dr. G. M. Dreosti, M.Sc. (S.A.), Ph.D. (Utrecht)--formerly Officer-in-Charge of Dehydration and Cold Storage, Union Department of Agriculture.

The main functions of the Institute are to undertake research into the practical problems met with by the industry as a whole, or which are of practical interest to a whole section of the industry. The Institute will be closely associated with the technical staffs of the industry, and the investigations will--at any rate initially--be, for the most part, of the practical type which are likely to furnish early answers to problems confronting the industry.

The work will also include analyses of the materials used in the canning, salting, and smoking of fish, and in the industry generally, and their effects on the final products. Scientific and technical enquiries will be welcomed, and will be answered as well as possible within the scope of the Institute. The Institute will also endeavor, by means of bulletins, to keep the industry informed of new ideas, methods, and findings contained in scientific and technical literature, (or secured by other means) which are considered to be of interest in South Africa. It will collaborate closely with related laboratories overseas and in the Union.

Generally speaking, the Institute will primarily concentrate upon problems in the wide fields of processing, preservation, and transport of fish and fish products, whilst the Division of Fisheries will conduct long-term biological investigations. The value of the industry does not only depend upon matters connected with the actual catching of fish, but also largely upon the effective use made of the whole catch. Initially the Institute will concern itself principally with the scientific fundamentals underlying present practices, and with attempts at the improvement of both practices and final products, and the avoidance of waste, rather than the development of entirely new techniques and products.

Norway

FISHERIES: Uruguay has invited a number of Norwegian fishermen to take part in the shark fishery, according to the Royal Norwegian Information Service. A motor cutter will leave Trondhjem for Uruguay with a 10-man crew in the near future. The cutter is equipped with radar and a depth finder and expects to take four months for the trip.

Norway has directed a request to the Allied Control Council in Berlin to the effect that the number of German trawlers not be increased before the extent of Germany's future participation in the ocean fisheries has been finally decided.

FEDERAL LEGISLATION, DECISIONS, ORDERS, ETC.

Department of the Interior

ENFORCEMENT OF SOCKEYE SALMON FISHERY ACT OF 1947: Executive Order 9892, which designated the Fish and Wildlife Service as the agency responsible for the enforcement of the Sockeye Salmon Fishery Act of 1947, was approved by the President on September 20, 1947. The text of the Executive Order follows:

EXECUTIVE ORDER 9892

DESIGNATING THE FISH AND WILDLIFE SERVICE AS THE AGENCY RESPONSIBLE FOR THE ENFORCEMENT OF THE SOCKEYE SALMON FISHERY ACT OF 1947

BY VIRTUE OF THE AUTHORITY VESTED IN ME BY SECTION 6 (a) OF THE SOCKEYE SALMON FISHERY ACT OF 1947 (PUBLIC LAW NO. 255, 80TH CONGRESS), AND AS PRESIDENT OF THE UNITED STATES, I HEREBY DESIGNATE THE FISH AND WILDLIFE SERVICE OF THE DEPARTMENT OF THE INTERIOR AS THE FEDERAL AGENCY WHICH SHALL BE RESPONSIBLE, UNDER THE DIRECTION OF THE SECRETARY OF THE INTERIOR, FOR THE ENFORCEMENT OF THE PROVISIONS OF (1) THE SAID SOCKEYE SALMON FISHERY ACT OF 1947, (2) THE CONVENTION BETWEEN THE UNITED STATES OF AMERICA AND THE DOMINION OF CANADA FOR THE PROTECTION, PRESERVATION, AND EXTENSION OF THE SOCKEYE SALMON FISHERY OF THE FRASER RIVER SYSTEM, SIGNED AT WASHINGTON ON MAY 26,1930; AND (3) THE REGULATIONS OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION, CREATED PURSUANT TO ARTICLE II OF THE SAID CONVENTION.

HARRY S. TRUMAN

Interstate Commerce Commission

ICC RATE DECISION: The Interstate Commerce Commission published, on October 6, its report and decision on the petition of the railroads to increase freight rates and service charges immediately, and without prejudice to the petitions of July 23 and September 5, 1947.

The Commission approved an increase of 10 percent for all commodities, except coal, coke, and iron ore. No increase was approved in the charges for protective services against heat or cold. The latter decision means a saving for the fishery industries since icing charges are an important part of their transportation costs. Icing charges run, on the average, $125 per carload. The saving to the fishery industries resulting from the denial of a 10 percent increase in these service charges is estimated as being $150,000.

The Commission also announced that the case will be continued, and will be set for hearings as speedily as possible in convenient places for each of the four rate territories. Place and date of these hearings will be determined later.

Testimony will then be received as to the specific proposals of the railroads. The general basis for the increases sought was 38 percent in the eastern district and 28 percent elsewhere.

RECENT FISHERY PUBLICATIONS

Listed below are informational publications which recently have been processed by the Division of Commercial Fisheries. FL publications are available free of charge, from the Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D. C. Other listed publications may be obtained, also free of charge, from the Division of Commercial Fisheries, Fish and Wildlife Service, Washington 25, D. C.

Number		Title
CFS-326		- Lake Fisheries, 1944
CFS-332	(Revised)	- Pacific Coast Fisheries, 1944
CFS-334		- Middle Atlantic Fisheries, 1943
CFS-339		- Middle Atlantic Fisheries, 1944
CFS-341		- New England Fisheries, 1943
CFS-342		- Chesapeake Fisheries, 1944
CFS-350		- New England Fisheries, 1944
CFS-351		- Lake Fisheries, 1945
CFS-354		- Fisheries of the U. S. and Alaska, 1943
CFS-355		- Manufactured Fishery Products, 1943
CFS-356		- Manufactured Fishery Products, 1944
CFS-359		- Fish Meal and Oil, May 1947
CFS-360		- Fish Meal and Oil, June 1947
CFS-361		- Frozen Fish Report, August 1947
CFS-363		- Massachusetts Landings, May 1947
CFS-364		- Frozen Fish Report, September 1947
CFS-365		- Maine Landings, July 1947
CFS-366		- Fish Meal and Oil, July 1947
FL-66	(Revised)	- Preservation and Care of Fish Nets
FL-258		- Retailing Fish
FL-261		- A Partial Bibliography Relating to Agar
FL-262		- Crab Pot Construction

Reprints (Separates) from Commercial Fisheries Review, September 1947.

Sep. No. 184 - Relationship Between Body Length of Grayfish and Vitamin A in Liver
Sep. No. 185 - Chemical Studies of Lipoid Extracts from Menhaden Fish Meal
Sep. No. 186 - Studies on Methods of Extracting Vitamin A and Oil from Fishery Products - Part I-Vitamin A Potencies of Oils from Grayfish Livers Obtained by Extraction with Petroleum Ether and by Cooking with Water

Designations for fishery publications are interpreted as follows:

CFS - Current fishery statistics of the United States and Alaska.

SL - Statistical lists, consisting of lists of dealers of fishery products and manufacturers of byproducts.

FL - Fishery leaflets.

MDL - Market development lists of frozen food locker plants and locker associations.

Illustrators - Shirley A. Briggs and Gustaf T. Sundstrom

Compositors -- Jean Zalevsky and Norma D. Loeffel
Processing -- Miscellaneous Service Division

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DEPARTMENT OF THE INTERIOR
FISH AND WILD LIFE SERVICE
WASHINGTON 25, D. C.

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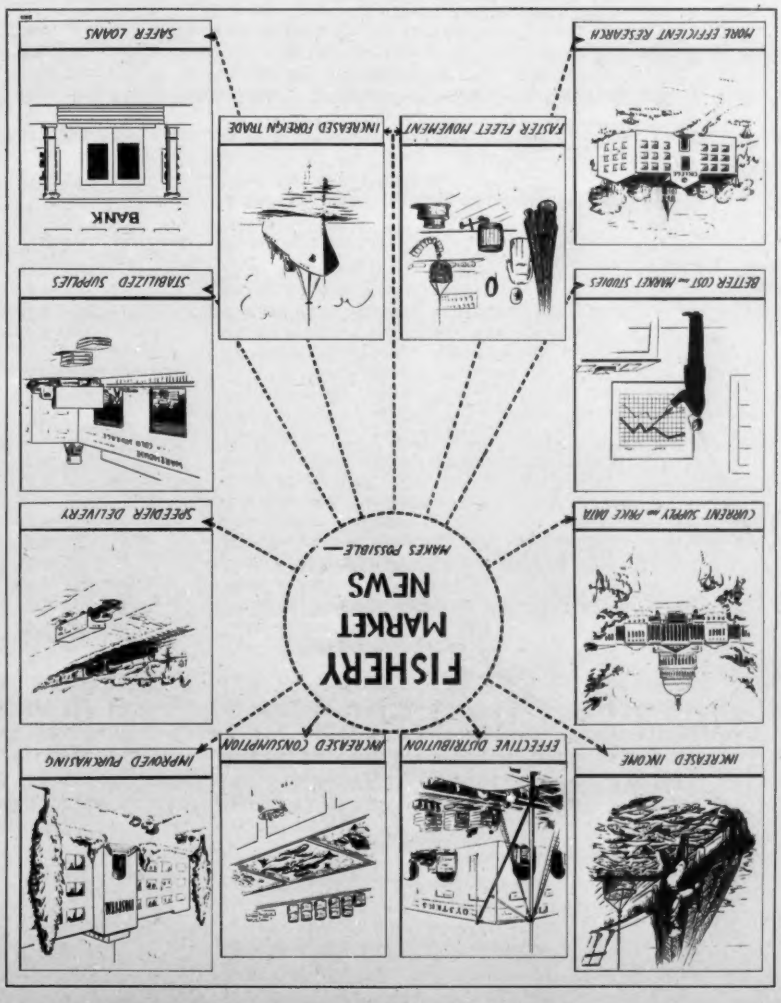
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